TM 11-5840-217-20

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORGANIZATIONAL MAINTENANCE SECOND ECHELON

RADAR SET AN/TPS-25

HEADQUARTERS, DEPARTMENT OF THE ARMY
JUNE 1959

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working inside the units (with or without the interlock switches disabled), or on the 115-volt ac line connections.

DON'T TAKE CHANCES

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING UNITS:

Radar Receiver-Transmitter RT–500/TPS–25	16, 000-volt circuits
Radar Modulator MD–344/TPS–25	3, 800-volt circuits
Radar Set Control C–2715/TPS–25	2, 000-volt circuits
Servo Data Coordinator SN–231/TPS–25	2, 000-volt circuits
Power Supply PP–2166/TPS–25	845-volt circuits

GASOLINE HANDLING

Do not refuel the engine generator and/or heater, and do not handle or leave open gasoline containers or plastic gasoline container (open or closed) in the vicinity of the radar set while the radar transmitter is on.

RADIOACTIVITY HAZARDS

The following tubes used in Radar Set AN/TPS–25 are radioactive. Dangers of poisoning from the radioactive materials contained in the tubes exist if a tube is broken. For detailed instructions on handling, storing, and disposing of radioactive tubes, see TB SIG 225.

Tube types	Where used	Symbol No.
TU–1271	Receiver-transmitter	V2.
5783WA	Receiver-transmitter	V401 through V405.
6627/OB2WA	Power supply	V1809, V1810.
OA2WA	Power supply	V1805, V1808.

MICROWAVE RADIATION HAZARD

Do not stand in front of the antenna while the radar set is operating. The transmitted energy can cause severe RF burns. Radiation levels, extremely dangerous to personnel, exist in the radar beam up to a distance of 40 feet from the antenna. Exposure of personnel to the stationary beam from the antenna at this distance should be limited to 10 minutes (see *warning*, ch. 2, sec. I).

POISONOUS FUMES FROM SELENIUM RECTIFIERS

Selenium rectifiers are used in Radar Transmitter Receiver RT–500/TPS–25. The failure of selenium rectifiers can result in the liberation of poisonous fumes and the deposit of poison selenium compounds. If a rectifier burns or arcs over, the odor is strong. Provide adequate ventilation immediately. *Avoid inhaling the fumes and do not handle the damaged rectifier until it has cooled.*

GPO 806–227–1

TECHNICAL MANUAL
No. 11-5840-217-20

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *8 June 1959*

RADAR SET AN/TPS-25

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CHAPTER 1

INTRODUCTION

1. Scope

a. This manual covers second echelon maintenance of Radar Set AN/TPS–25.

b. This manual contains instructions for preventive and corrective maintenance permissible at the organizational level. It also presents the basic theory of operation and a list for checking the performance of the equipment. Packaging directions for shipment and/or limited storage of the equipment are provided in chapter 4. Appendix I contains a list of pertinent references. The maintenance allocation chart is provided in appendix II.

2. Comments

Forward comments concerning this manual to the Commanding Officer, United States Army Signal Publications Agency, Fort Monmouth, N.J.

Note. For applicable forms and records, see paragraph 2, TM 11–5840–217–10.

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
26. ~~INSPECT ANTENNA FOR BOOSH/INSULATOR, CORROSION, LOOSE PIP, DAMAGED INSULATORS AND REFLECTORS.~~	
27. CHECK FOR NORMAL OPERATION. PAR. 13	✓
28. ~~BEFORE SHIPPING OR STORING, REMOVE BATTERIES.~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

ITEM 18. RESISTOR R810 DISCOLORED AND APPEARS TO OVERHEAT. REPORTED TO 3RD ECHELON MAINTENANCE FOR REPLACEMENT.

FOLD

MAINTENANCE CHECK LIST FOR SIGNAL EQUIPMENT
SOUND EQUIPMENT, RADIO, DIRECTION FINDING
RADAR, CARRIER, RADIOSONDE AND TELEVISION
(AR 750-625)

EQUIPMENT NOMENCLATURE: RADAR SET AN/TPS-25

EQUIPMENT SERIAL NUMBER: 159

INSTRUCTIONS

This form may be used for a period of one month by using the correct dates and weeks of the month. It is to be used as a Preventive Maintenance check list for Signal equipment in actual use, or for a check on equipment prior to issue.

1. For detailed Preventive Maintenance instructions see:
   a. The Technical Manual *(in TM 11 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   b. The Supply Bulletin *(SB 11-100 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   c. The Department of the Army Lubrication Order. *(See DA Pamphlet Number 310-4)*

2. The following action will be taken by either the Communications Officer/ Chief for 1st echelon, or the Inspector for higher echelon:
   a. Enter Equipment Nomenclature and Serial Number.
   b. Strike out items that do not apply to the equipment.

3. Operator/Inspector will enter in the columns entitled CONDITION, on the proper line, a notation regarding the condition, using symbols specified under LEGEND.

4. After operator completes each daily inspection he will initial over the appropriate dates under "Daily Condition for Month", then return form to his supervisor.

TYPE OF INSPECTION

OPER-ATOR	2/3 ECH-ELON	DATE	SIGNATURE
	✓	3 APRIL 59	Kenneth Sickles
	✓	10 APRIL 59	Stephen McPat
	✓	17 APRIL 59	Kenneth Sickles
	✓	24 APRIL 59	Stephen McPat

DA FORM 1 MAY 57 11-238

REPLACES DA FORMS 11-238, 1 NOV 55; 11-239, 11-244, 11-245, 11-248, 11-249, 11-250, AND 11-251; WHICH ARE OBSOLETE.

TM5840-217-20-1

Figure 1. DA Form 11–238, pages 1 and 4.

LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF APRIL 1959

NO.	DAILY ITEM	1 17	2 18	3 19	4 20	5 21	6 22	7 23	8 24	9 25	10 26	11 27	12 28	13 29	14 30	15 31	16	2D 3D ECHELON
1.	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT. *(Transmitter, receiver, ~~carrying cases, misc~~, cables, ~~microphones, tubes~~, spare parts, technical manuals).* PAR. 5b																	✓
2.	CLEAN DIRT AND MOISTURE FROM ~~ANTENNAS, MICRO-PHONES~~, HEADSETS, ~~MEMO~~, JACKS, PLUGS, COMPONENT PANELS. PAR. 5b																	✓
3.	INSPECT CONTROLS FOR NORMAL OPERATION. TAP CONTROLS LIGHTLY FOR EVIDENCE OF CUT-OUT FROM LOOSE CONTACTS.																	✓
4.	CHECK FOR NORMAL OPERATION OF EQUIPMENT. BE ALERT FOR UNUSUAL OPERATION OR CONDITION.																	✓

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D 3D ECH
5. CLEAN AND TIGHTEN EXTERIORS OF CASES, RACKS, MOUNTS, TRANSMISSION LINES. PAR. 5b						✓
6. INSPECT CASES, MOUNTS, ANTENNA TOWERS AND EXPOSED METAL SURFACES FOR RUST, CORROSION.						✓
7. INSPECT CORDS, CABLE, ~~WIRE~~, SHOCK MOUNTS FOR CUTS, KINKS, BREAKS, FRAYING, UNDUE STRAIN. PAR. 5b						✓
8. CHECK ANTENNA GUY WIRES FOR PROPER TENSION OR DAMAGE.						✓
9. INSPECT CANVAS ~~AND LEATHER~~ ITEMS FOR MILDEW, TEARS, FRAYING.						✓
10. INSPECT ACCESSIBLE ITEMS FOR LOOSENESS: SWITCHES, KNOBS, JACKS, CONNECTORS, RELAYS, TRANSFORMERS, MOTORS, PILOT LIGHTS, BLOWERS, ETC. PAR. 5b						Ø
11. CLEAN AND/OR INSPECT AIR FILTERS, ~~GRASS-HAME PLATES~~, DIAL AND METER WINDOWS PAR. 5b	✓	✓	✓	✓		Ø
12. ~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, SPECIFIC GRAVITY, DAMAGED CASES. INSPECT DRY BATTERIES FOR LEAKAGE.~~						

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
13. INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER-PROOFING, TEARS, FRAYING.	✓
14. ~~CHECK TERMINAL BOX COVERS FOR GASKETS, DIRT, LEAKS, DAMAGED GASKETS, GREASE.~~	

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
15. INSPECT SEATING OF READILY ACCESSIBLE PLUCK-OUT ITEMS: ~~FUSES~~, LAMPS, FUSES, ~~CRYSTALS~~, CONNECTORS, ~~VIBRATORS, PLUG-IN COILS~~	✓
16. ~~INSPECT RELAYS AND CIRCUIT BREAKERS FOR LOOSE MOUNTINGS, BAD CONTACTS, MIS-ALINEMENT OF CON-TACTS AND SPRINGS, PROPER SPRING TENSION.~~	
17. ~~INSPECT VARIABLE CAPACITORS FOR DIRT, MIS-ALINEMENT OF PLATES, LOOSE MOUNTINGS, MOISTURE.~~	
18. INSPECT RESISTORS, BUSHINGS AND INSULATORS FOR CRACKS, CHIPPING, BLISTERING, MOISTURE, DISCOLORATION.	X
19. CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.	✓
20. INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.	✓
21. INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR DIRT, CORROSION, LOOSE CONTACTS.	✓
22. INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS AND RHEOSTATS FOR OVERHEATING ~~AND OIL LEAKAGE~~.	✓
23. ~~INSPECT GENERATORS, AMPLIDYNES, DYNA-MOTORS FOR BRUSH WEAR, SPRING TENSION, ARCING AND FITTING OF COMMUTATOR.~~	
24. INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	✓
25. INSPECT WATERPROOF GASKETS FOR LEAKS, WORN OR LOOSE PARTS. PAR. 5b	✓

CONTINUED ON PAGE 4

2 3

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TM5840-217-20-2

Figure 2. DA Form 11–238, pages 2 and 3.

CHAPTER 2

MAINTENANCE INSTRUCTIONS

Section I. GENERAL

Warning: **Beware of the existing radiation hazard when working on or around equipment while it is radiating. Overexposure to RF energy is injurious to personnel. Avoid direct exposure to the radiating beam when the antenna is stationary. Do not stand in front of the antenna when it is stationary and while the equipment is transmitting. Exposure to the beam with the antenna stationary at a distance of 40 feet should be limited to not more than 10 minutes. Exposure at shorter distances should be limited accordingly and avoided entirely if possible. At a distance of 126 feet or more from the antenna, the radiation level within the antenna beam is not injurious to personnel. Limit direct exposure in the stationary beam at distances between 40 feet and 126 feet on the basis of a maximum of 10 minutes permissible exposure at 40 feet.**

3. Scope of Maintenance

Second echelon maintenance of Radar Set AN/TPS–25 consists of the following:

a. Replacement of fuses and indicator lamps (par. 103, TM 11–5840–217–10).

b. Preventive maintenance (par. 5).

c. Visual inspection (par. 10).

d. Troubleshooting (par. 10–14).

e. Testing and replacement of tubes (par. 15–19).

f. Checking for defective cables (par. 20).

g. Replacement of pluck-out crystals (par. 21).

h. Adjustment of crystal mixer currents (par. 22).

i. Adjustment of range counters (par. 24).

j. Adjustment of X and Y counters (par. 25).

k. Replacement of plotting board indicator light and shelter lights (par. 26).

l. Focusing of plotting board indicator light (par. 27).

m. Zeroing of plotting board indicator light (par. 28).

4. Tools, Materials, and Test Equipment Required

The tools, materials, and test equipment required for this maintenance are listed below.

a. Tools.

(1) Tool Equipment TE–73.

(2) Attenuator adjustment tool (B, fig. 3), stored in cover of receiver-transmitter front panel. This tool fits through ATTEN 1 ADJ and ATTEN 2 ADJ access holes on the receiver-transmitter front panel, and is used to adjust the crystal mixer currents.

(3) No. 4 Allen wrench (A, fig. 3), stored on cover plate of plotting board access hole. This wrench is used to focus the plotting board indicator light.

b. Materials.

(1) Cloths, textile, lint-free.
(2) Abrasive crocus cloth.
(3) Abrasive sheet, sandpaper No. 0000.
(4) Zinc-chromate primer.
(5) Finish paint, green lusterless enamel.
(6) Tape TL–83, friction, ¾ in.
(7) Tape TL–193, rubber, ¾ in.
(8) Dishwashing compound or detergent.
(9) Filter oil (viscosine).
(10) Cleaning compound (Federal stock No. 7930–395–9542).

c. Test Equipment.

(1) Multimeter TS–352/U or AN/URM–105. The multimeter is used for voltage and continuity measurements.

(2) Electron Tube Test Set, TV–7/U. Used for testing all vacuum tubes that the second echelon repairman is permitted to replace.

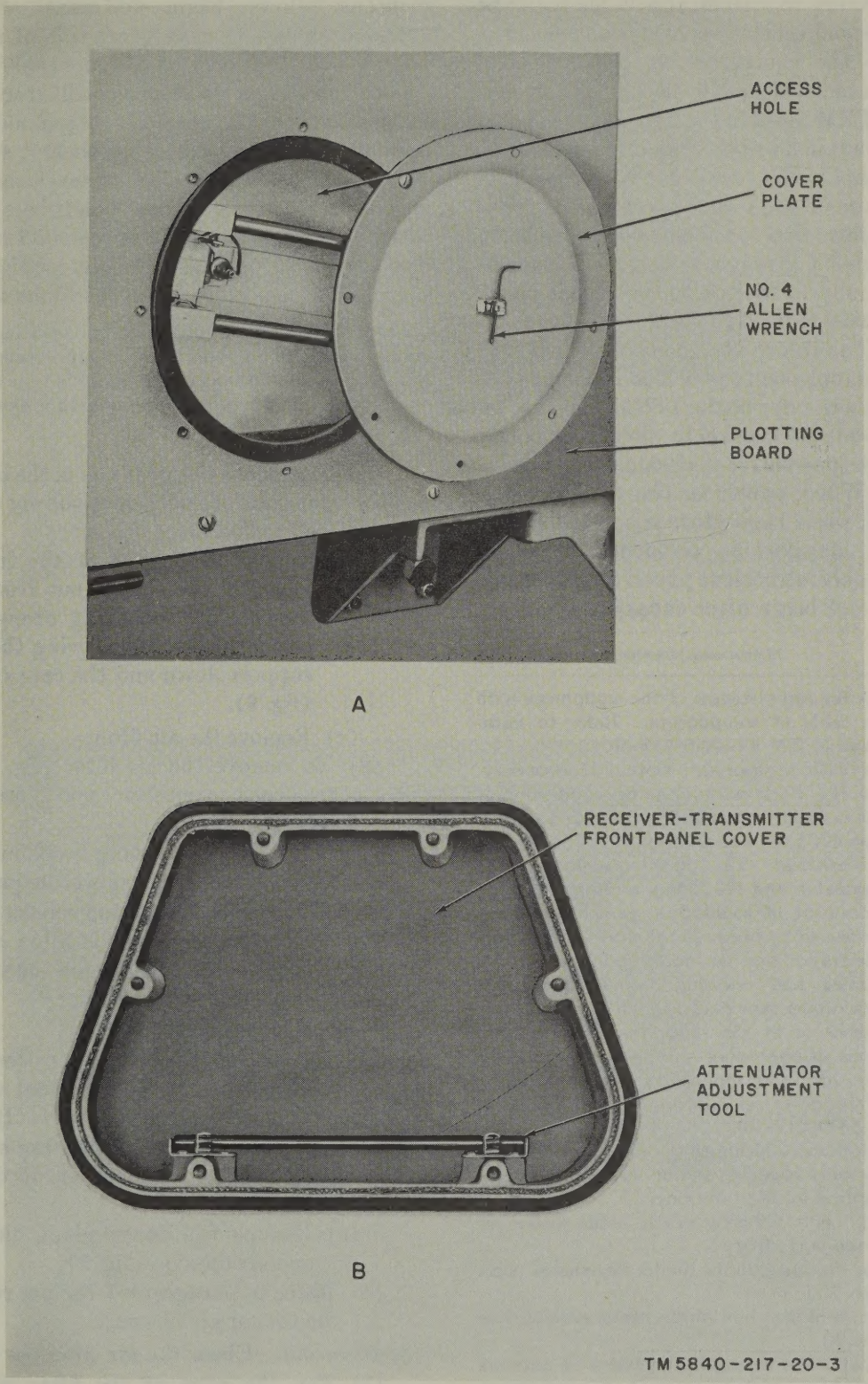


Figure 3. Location of special tools.

5. Preventive Maintenance

a. DA Form 11–238. DA Form 11–238 (figs. 1 and 2) is a preventive maintenance check list to be used by the second echelon repairman. Items not applicable to the equipment or organizational maintenance are lined out in the figures. References in the ITEM block in the figures are to paragraphs that contain additional maintenance information pertinent to the particular item. Instructions for the use of the form appear on the form. Additional preventive maintenance information concerning items 1 through 11 on DA Form 11–238 will be found in the preventive maintenance portion of TM 11–5840–217–10.

b. Items. The information shown in this subparagraph is supplementary to DA Form 11–238. The item numbers refer to the ITEM numbers on the form. Obtain permission to disconnect power as required for preventive maintenance checks.

***Warning:* When power to the equipment is disconnected, some capacitors may still retain voltages of dangerous potential. Before touching exposed electrical parts, short-circuit the terminals of large filter capacitors.**

Item	Maintenance procedure
1	Check for completeness of the equipment with the table of components. Refer to paragraph 5, TM 11–5840–217–10.
2	Clean with a clean dry cloth. If necessary, wet the cloth with cleaning compound or dishwashing compound; clean parts; then wipe dry with a clean cloth. ***Warning:* The cleaning compound is flammable and the fumes are toxic.**
7	Replacement of connectors on cables will be performed by higher echelon personnel. Repair frayed and cut cable insulation by insulating and covering the damaged area with rubber tape and then with friction tape.
10	Wrenches to fit the setscrews of the control knobs (if tightening or replacement is necessary) are to be found inside the front cover of the radar set control unit (fig. 75, TM 11–5840–217–10).
11	In addition to cleaning the air filters (par. 6) a weekly cleaning and/or inspection will be required for the following: *a.* Light diffusing grilles in the shelter air intake ports (par. 7). *b.* Screening in the shelter air exhaust ports (par. 7). *c.* Sediment bowl in the heater gasoline line (par. 8).
25	Pay particular attention to gaskets on antenna assembly, modulator, and receiver-transmitter units. These units are constantly exposed to the outside weather.

6. Cleaning Air Filters

Eight metallic air filters are located in the equipment as follows: Right side panel of receiver-transmitter unit (fig. 14), left side of modulator case (fig. 4), left side of power supply case (fig. 5), left and right sides of coordinator case (fig. 6), right side of the radar set control unit (fig. 7), and left and right sides of the shelter, at entrance (B, fig. 11). These filters must be cleaned at least once a month under normal conditions and more often when the equipment is operated under dry, dusty, and/or high temperature conditions, or if the weekly inspection reveals the filters to be dirty.

Note. If operating under dusty conditions, a daily inspection of the air filter in the receiver-transmitter unit is required. The magnetron is protected by an air vane cutout switch and will not operate with a dirty air filter.

a. Removal.

(1) To remove the air filters in the modulator, coordinator, and power supply units, proceed as follows:
   (*a*) Loosen the latches on the front panel and pull the chassis out from case.
   (*b*) Loosen the mounting screws at each corner of the filter, swing the forward support down and the rear support up (fig. 8).
   (*c*) Remove the air filter.

(2) To remove the air filter (fig. 9) in the receiver-transmitter unit, proceed as follows:
   (*a*) Loosen the 14 wing bolts on the right side panel and remove the panel.
   (*b*) Loosen the mounting screws (B, fig. 9) at each corner of the filter, and swing the slotted end of the support away from the filter (A, fig. 9).
   (*c*) Remove the air filter.

(3) To remove the air filter in the radar set control unit (fig. 10), proceed as follows:
   (*a*) Open the air filter cover (B, fig. 10).
   (*b*) Remove the four mounting screws (B, fig. 10) at each corner of the louver plate.
   (*c*) Remove the louver plate, filter frame, and air filter (A, fig. 10).

(4) Refer to paragraph 7 for the removal of the shelter air filters.

b. Cleaning. Clean the air filters as follows:

(1) Tap the edge of the filter against an object to remove as much of the loose dirt as possible.

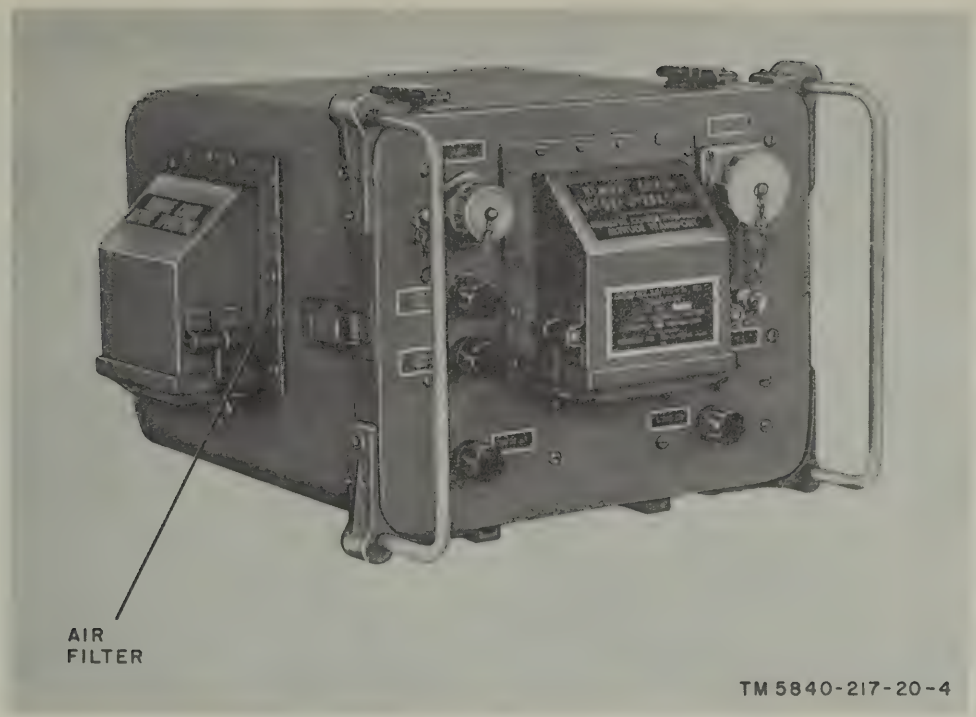


Figure 4. Location of modulator air filter.

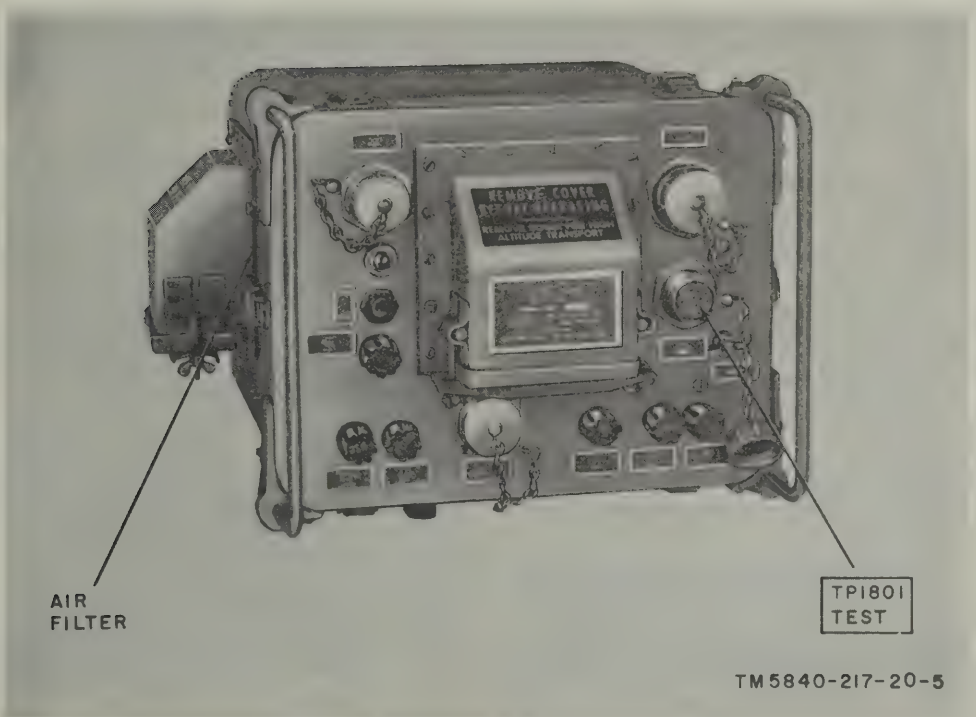


Figure 5. Location of power supply air filter and test point.

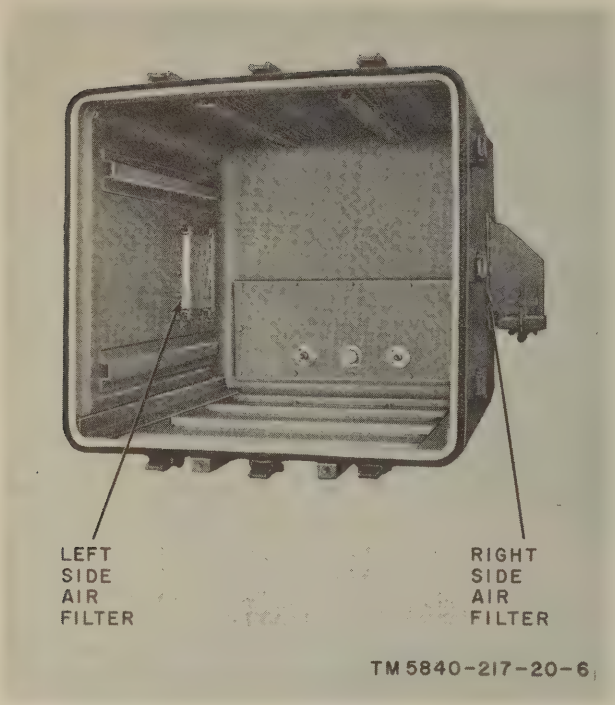


Figure 6. Location of coordinator air filters.

(2) Wash the filter in dishwashing compound or detergent and hot water; use a brush to remove dirt from the wire mesh.

(3) Rinse the filter thoroughly with hot water.

(4) After washing the filter, shake to remove excess water, and then place it flat on two supports. Let it drain and dry thoroughly before reoiling.

(5) Dip the filter in a bath of filter oil. Tap the edge of the filter against the tub to remove most of the excess oil.

(6) Place the filter flat across the two supports, with the arrowhead facing up. Allow the filter to drain about 12 hours before installation.

c. Replacement.

(1) To install the filters in the modulator, coordinator, and power supply units, proceed as follows:

(*a*) Place the filter across the opening, with the arrowhead toward the inside of the case (fig. 8).

(*b*) Close the filter supports around the filter by engaging the slots in the supports under the washers on the mounting screws.

(*c*) Tighten the four mounting screws.

(*d*) Return the chassis to the case and engage the front panel latches.

(2) To install the filter (fig. 9) in the receiver-transmitter unit, proceed as follows:

(*a*) Place the filter in place across the opening with the arrowhead away from the panel.

(*b*) Close the filter supports (A, fig. 9), around the filter by engaging the slots in the supports under the washers on the mounting screws.

(*c*) Tighten the four mounting screws (B, fig. 9).

(*d*) Replace the panel on the receiver-transmitter unit and tighten the 14 wing bolts.

(3) To install the filter on the radar set control unit (fig. 10), proceed as follows:

(*a*) Place the filter in the filter opening, with the arrowhead toward the unit.

(*b*) Place the filter frame over the filter (A, fig. 10).

(*c*) Place the louver plate over the filter frame, with the louver openings toward the rear of the unit (B, fig. 10).

(*d*) Secure the filter frame and louver plate in place with the four mounting screws (B, fig. 10).

(4) Refer to paragraph 7 for replacement of the shelter air filters.

7. Cleaning Diffusing Grilles and Screen

To remove and clean the air filters and light diffusing grilles in the shelter air intake ports, follow the procedure outlined in *a* below. The light diffusing grilles in the shelter exhaust ports are protected by a screen which will require monthly cleaning. The procedure for cleaning the screen is outlined in *b* below.

a. Cleaning of Shelter Air Filters and Diffusing Grilles. One air filter and two light diffusing grilles (fig. 11) are mounted in each air intake port of the shelter. To clean the filters and grilles, proceed as follows:

(1) Unscrew the captive wing bolt (B, fig. 11) located at the bottom of the filter frame and swing the hinged filter frame upward.

(2) Remove the air filter and both diffusing grilles (A, fig. 11) from the air intake port.

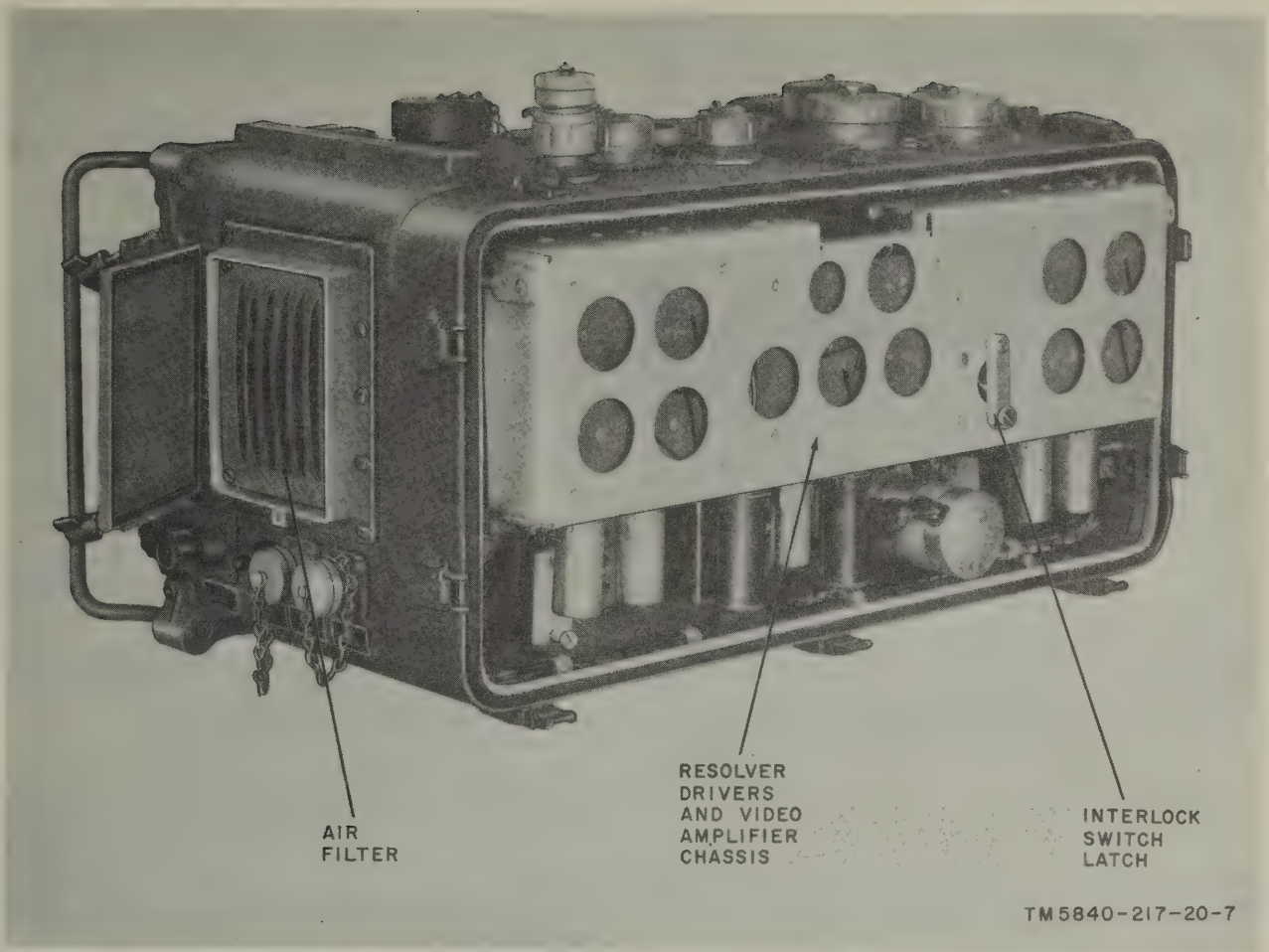


Figure 7. Radar set control, component locations.

(3) Clean the air filter as outlined in paragraph 6*b*.

(4) Clean the diffusing grilles as follows:

(*a*) Remove the loose dirt by tapping the grille against a solid object.

(*b*) Wash the grille with hot water and dishwashing compound or detergent. Use a brush to remove dirt from the louvers.

(*c*) Rinse with clean water, shake the grille, and allow it to drain until dry.

(5) Replace both grilles in the air intake port first, and then the air filter (A, fig. 11).

(6) Close the hinged filter frame and tighten the captive wing bolt.

b. Cleaning of Screen (fig. 12).

(1) Remove the six screws that hold the fan mounting to the fan mounting hood, and the self-tapping screw that holds the cable clamp (B, fig. 12).

(2) Tie the fan and fan mounting to the nearest antenna mast section support to remove the strain on the fan leads.

(3) Clean the screen (A, fig. 12) located in the opening of the fan mounting hood, with a brush.

(4) Untie the fan and fan mounting, and secure them to the fan mounting hood with the six screws ((1) above). Replace the cable and cable clamp; use the self-tapping screw.

8. Cleaning Sediment Bowl

(fig. 13)

The sediment bowl in the gasoline line to the shelter heater is located on the outside of the shelter forward wall. The bowl must be cleaned if the weekly inspection reveals sediment in the base of the bowl. Clean the sediment bowl as follows:

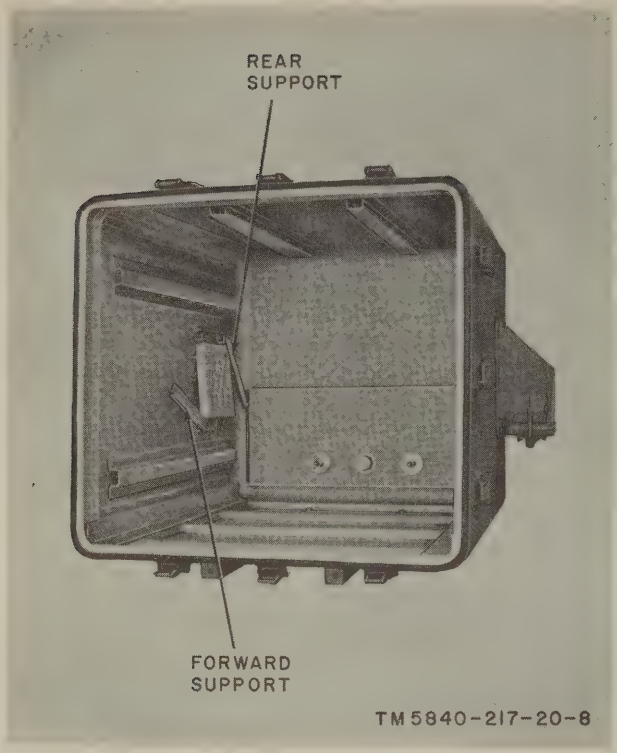


Figure 8. Removal of air filters from cased units.

a. Shut off the gasoline supply to the heater by pulling back on the shell of the connector (B, fig. 13) and removing the connector from the nipple.

b. Loosen the bowl support by turning the knurled nut (below bottom of bowl) counterclockwise.

c. Hold the bowl with one hand and swing the hinged bowl support up; remove the bowl.

Note. After the bowl is removed, see that the gasket for the bowl rim is in place on the strainer. If the gasket is loose, remove it so that it can be replaced properly (*f* below).

d. Remove gasoline and sediment from the bowl. Clean the inside of the bowl with a lint-free cloth.

e. Check the screen at the bottom of the bowl mount; if dirty, clean it by brushing with gasoline.

f. Replace the bowl in the mount. See that the gasket is properly positioned around the rim of the bowl.

g. Swing the hinged support to a vertical position and tighten the knurled nut fingertight.

h. Turn on the gasoline supply to the heater by replacing the gasoline line as follows:

(1) Hold the connector in one hand and pull the shell back to expose the retaining balls (B, fig. 13).

(2) Slip the connector over the nipple and release the shell.

9. Lubrication

The gear assemblies in the antenna assembly, radar set control unit, and the plotting table will require inspection by higher echelon maintenance personnel for cleanliness and sufficient lubrication every 6 months when the equipment is in use. The 6-month interval is based on 12-hour days. If the equipment is operated on the average of 6 hours a day, then a maximum interval of 1 year, between inspections, is permitted.

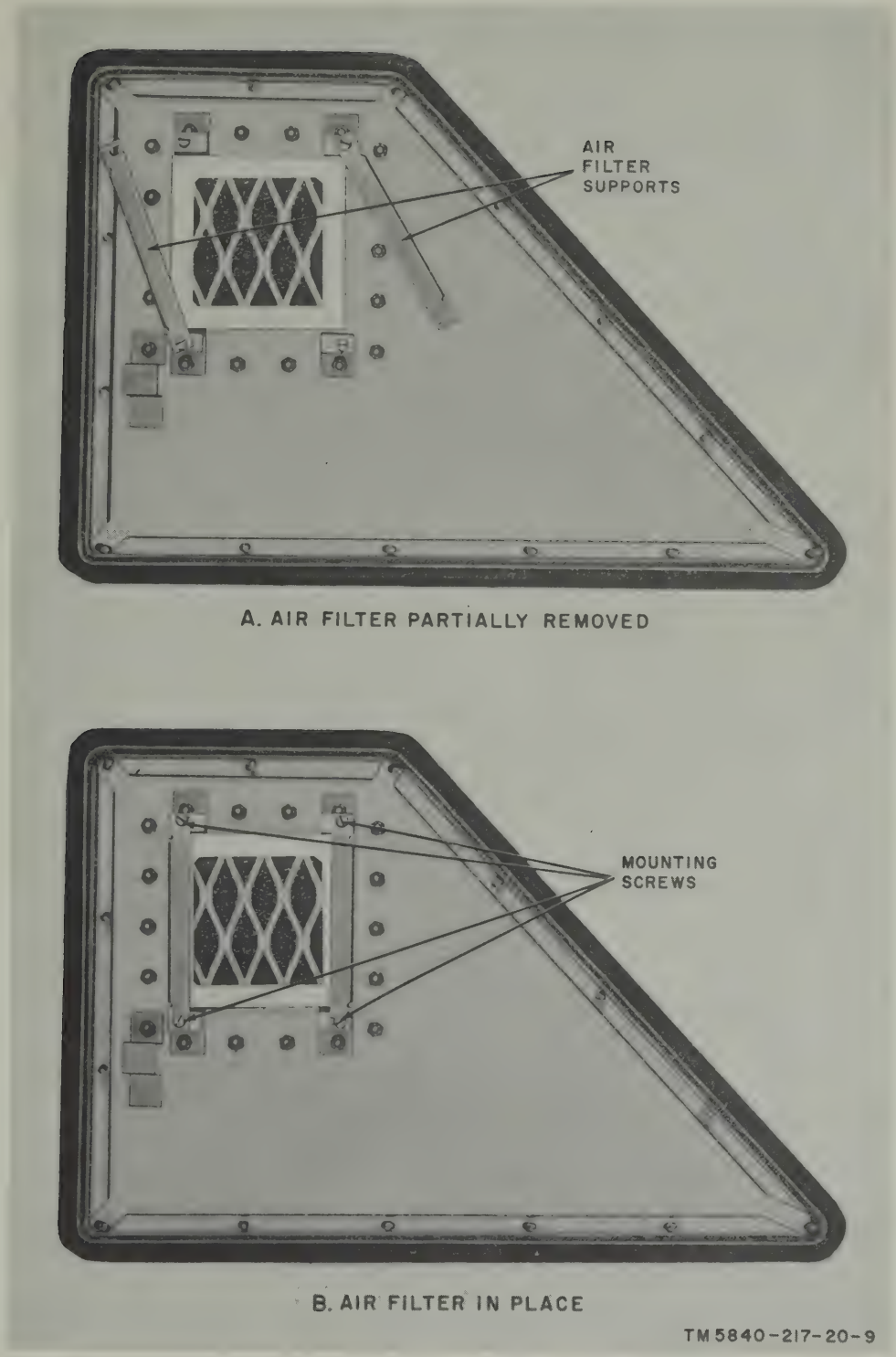


Figure 9. Removal of receiver-transmitter air filter.

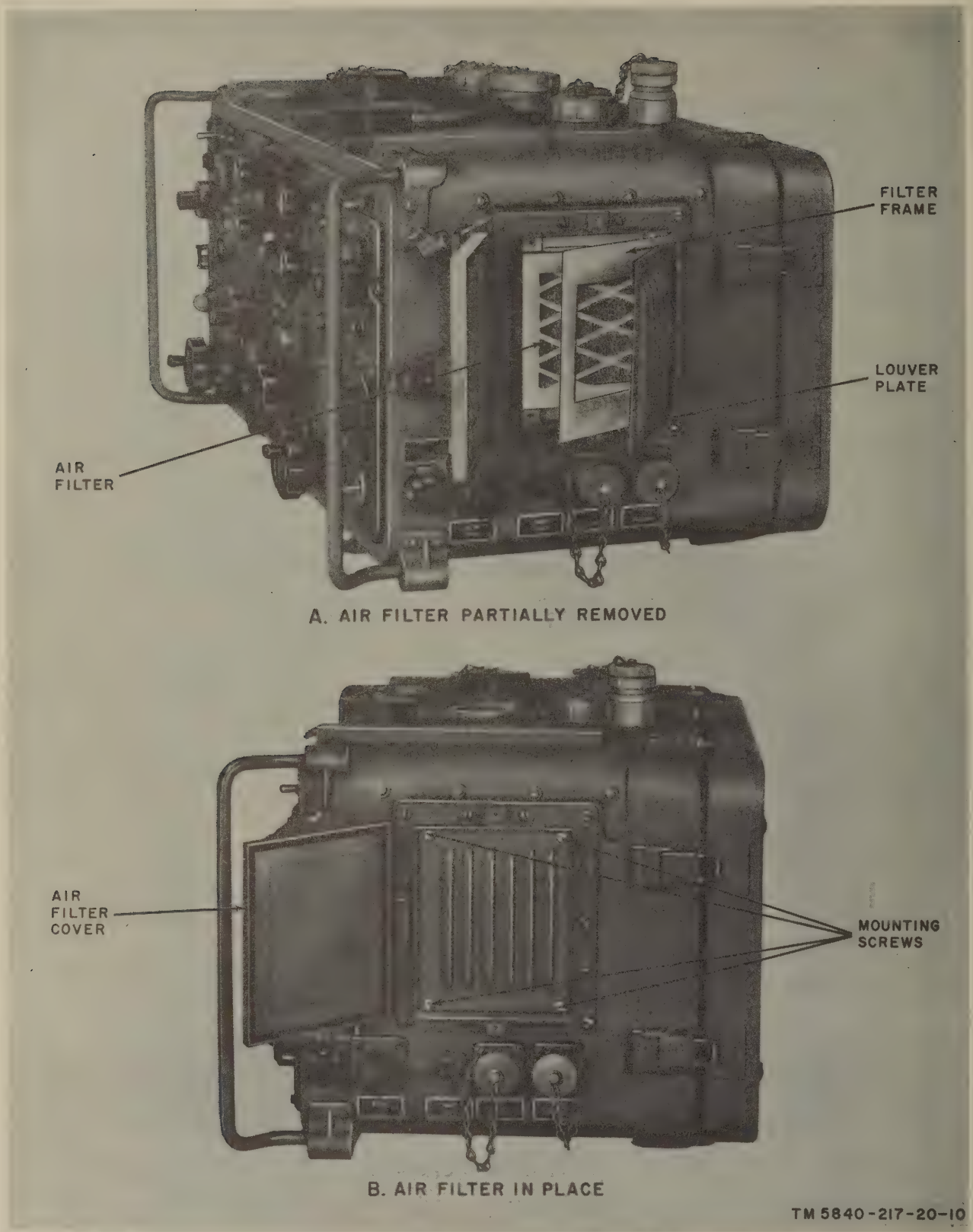


Figure 10. Removal of radar set control air filter.

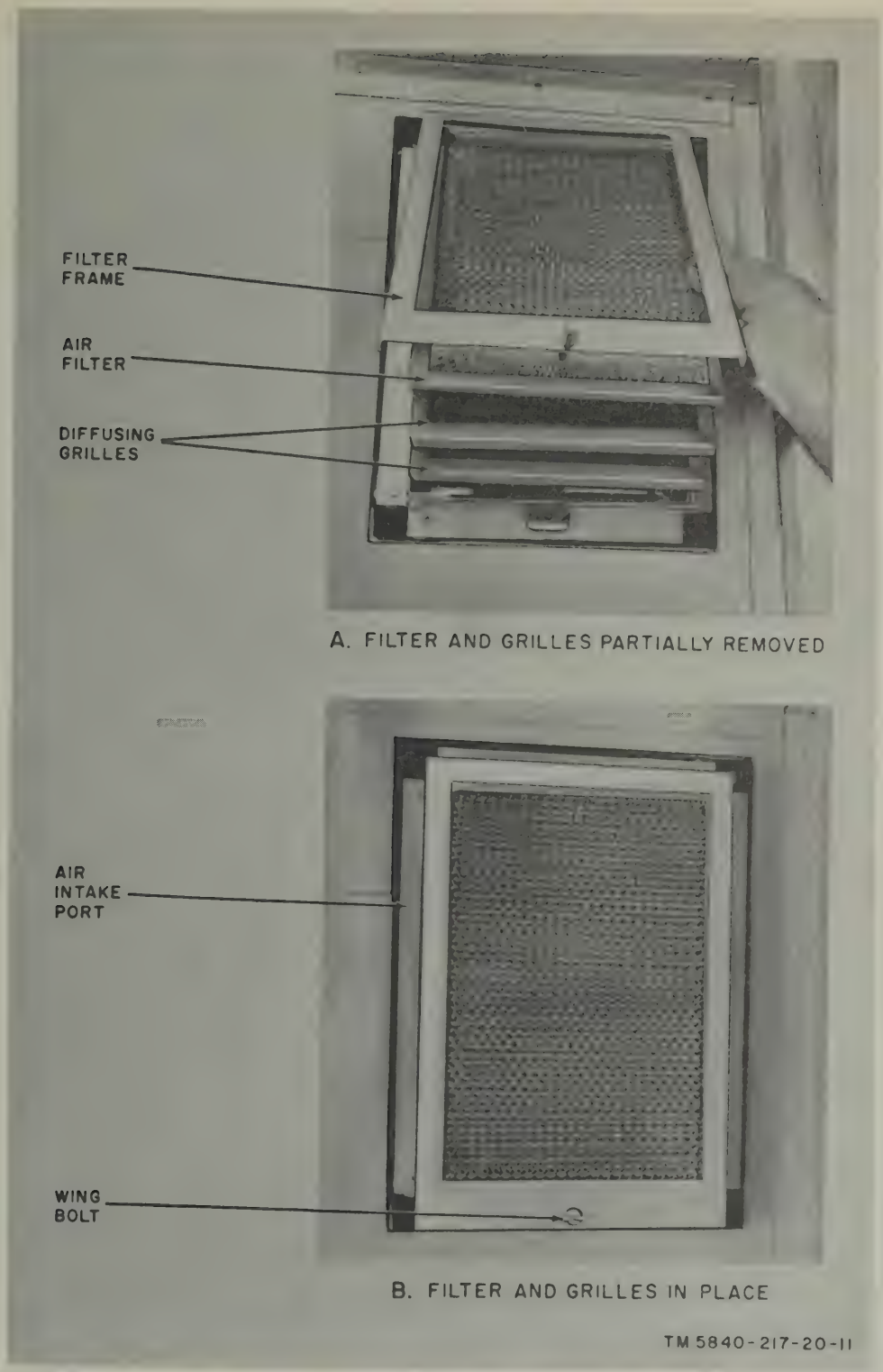


Figure 11. Removal of shelter air filters and diffusing grilles.

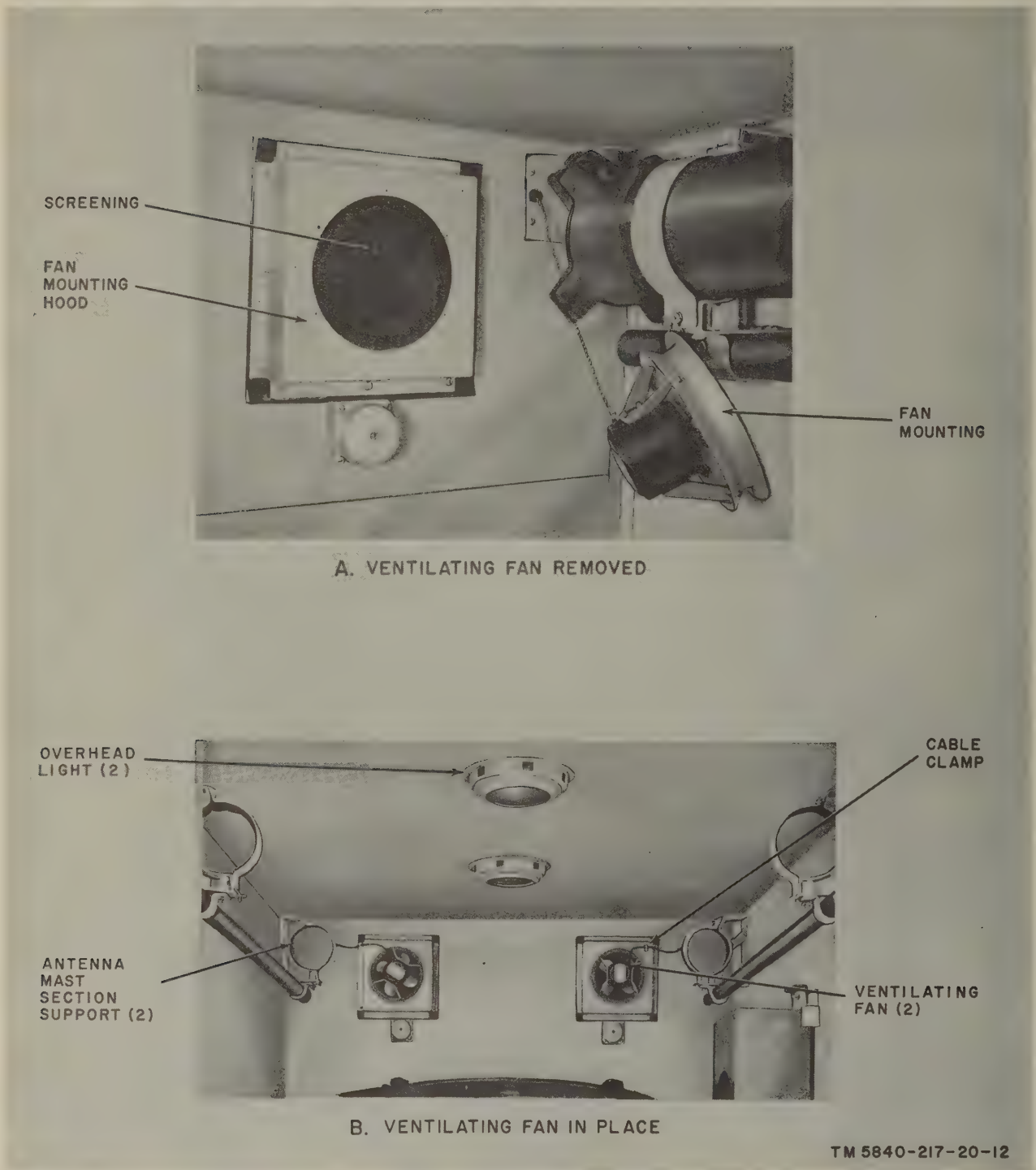
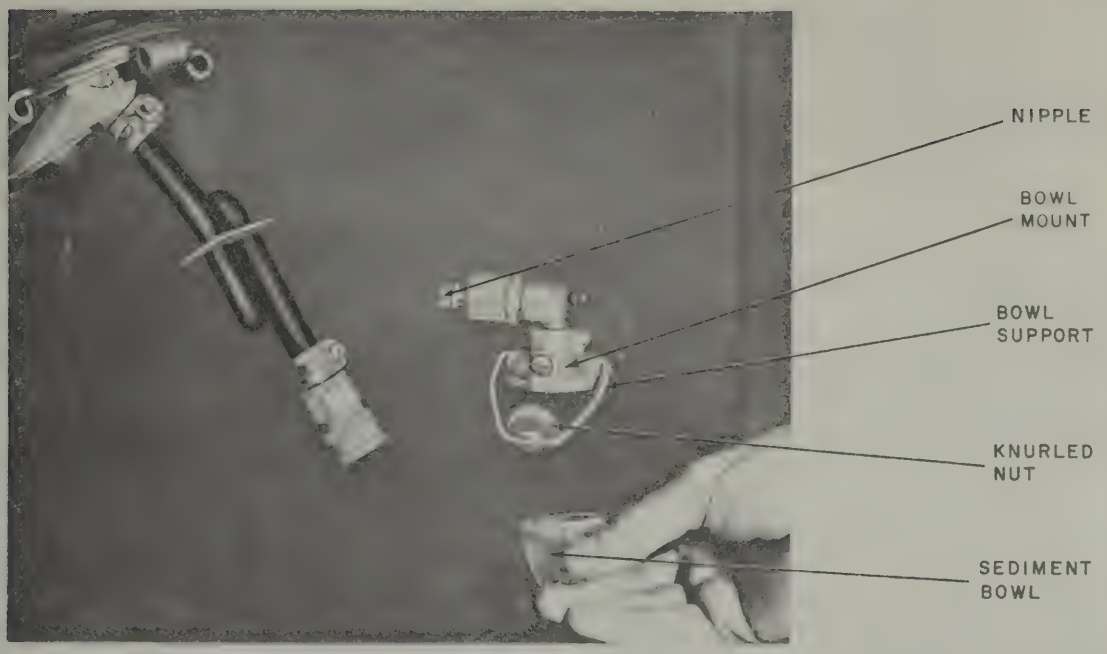
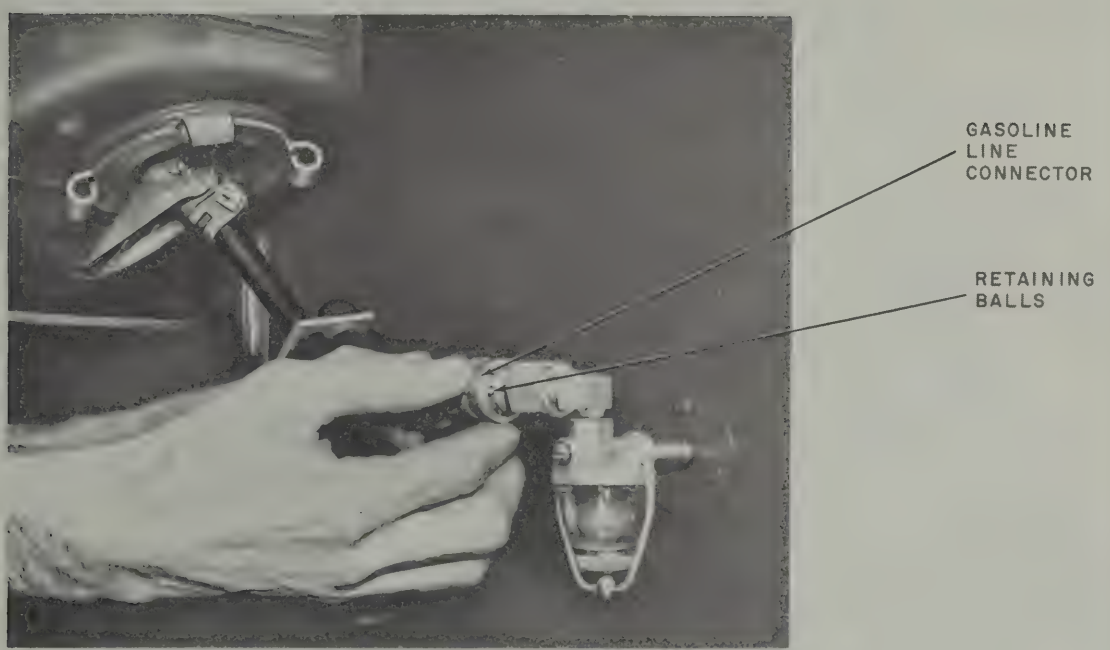


Figure 12. Shelter, component locations.



A. REMOVING SEDIMENT BOWL



B. REMOVING GASOLINE LINE CONNECTOR

TM5840-217-20-13

Figure 13. Removal of sediment bowl in heater gasoline line.

Section II. TROUBLESHOOTING

10. Visual Inspection

Troubles in a radar set are sometimes caused by defects that are easy to see. Check for as many of the following as are applicable to the problem before using more involved procedures.

a. Worn, broken, or disconnected cables or plugs (fig. 60 or 62, TM 11–5840–217–10).

b. Burned-out fuses (figs. 6, 8, 9, 10, 11, and 14, TM 11–5840–217–10).

c. Broken wires.

d. Unlighted tube filaments.

e. Improperly secured chassis and panels, which allow interlock switches to open under shock or vibration.

f. Obvious mechanical damage or abnormalities, especially to the antenna, waveguide, and other RF components.

g. Cracked or charred resistors.

h. Bulging or leaking capacitors.

i. Blistering of paint or other signs of overheating on synchros, transformers, chokes, and motors.

j. Discoloration of insulation on wires, and relay, transformer, and choke windings. Under heavy overload, some wires melt, resulting in no visible evidence except discoloration of the insulation.

11. Sectionalization of Trouble

Sectionalization of trouble consists of determining which of the radar set components is the cause of faulty operation. This may be done by a systematic analysis (*a–o* below). The block diagram (fig. 37) will aid in isolating trouble to a system.

a. Operate the radar set and observe its performance. Refer to the equipment performance check list (par. 13) for normal operating indications.

b. If the shelter equipment (heater lights and ventilating motors) and the radar units become inoperable, see that the engine generator is operating, connecting cables are undamaged, and circuit breakers on the shelter distribution box are holding.

c. If the shelter equipment operates, but all radar units become inoperable and the pilot light on the power supply front panel does not light, check the power supply fuses and the power cable from the shelter distribution box.

d. If the pilot lamp lights but the meter on the coordinator unit front panel reads zero, check interconnecting cables between the power supply, coordinator, and radar set control units. Be sure that the interlock switches on those units are closed.

e. If the meter reads correctly, but the radar is still inoperable, the trouble is probably in the power supply unit, transmitting system, or interconnecting cables.

f. The low voltage dc power supplies, overall (afc) operation, mixer circuits, and magnetron current may be checked on the front panel meter of the receiver-transmitter unit. The normal meter indications and the components responsible for abnormal meter indications are listed in table I.

g. If no meter indications can be obtained, check the fuses in the power supply and receiver-transmitter units, and the cables between the coordinator unit and receiver-transmitter unit. Be sure that the interlocks on the receiver-transmitter unit are closed.

h. If correct meter indications are obtained for the voltage positions of the meter switch, but all other positions are incorrect, check the cables between the receiver-transmitter unit, modulator unit, and antenna assembly. Be sure that the interlocks on the modulator unit and the right side of the receiver-transmitter unit are closed.

i. If all meter indications are normal, but no audio or video signals are received, check the voltages on the power supply unit (table II), and check the tubes in the signal circuits of the receiving system.

j. If video signals are received, but audio signals are no longer present, and the range gate is absent from the scope, check the tubes in the range timing circuits of the video and audio indicating system.

k. If video signals and the range gate are present on the scope, but audio signals are not present, check the tubes in the audio circuits of the video and audio indicating system, and the boxcar detector in the signal circuits of the receiving system.

l. If audio signals are present, but the range scope is blank, check the tubes in the scope timing circuits and/or the scope sweep circuits of the video and audio indicating system.

m. If the range and/or X or Y digital counters do not follow as the range crank is rotated, the trouble is in the computing system.

n. When a tube is suspected as the cause of trouble, check the tube in accordance with the instructions given in paragraph 14.

o. Use procedures similar to those given above to isolate other troubles to a particular system or units.

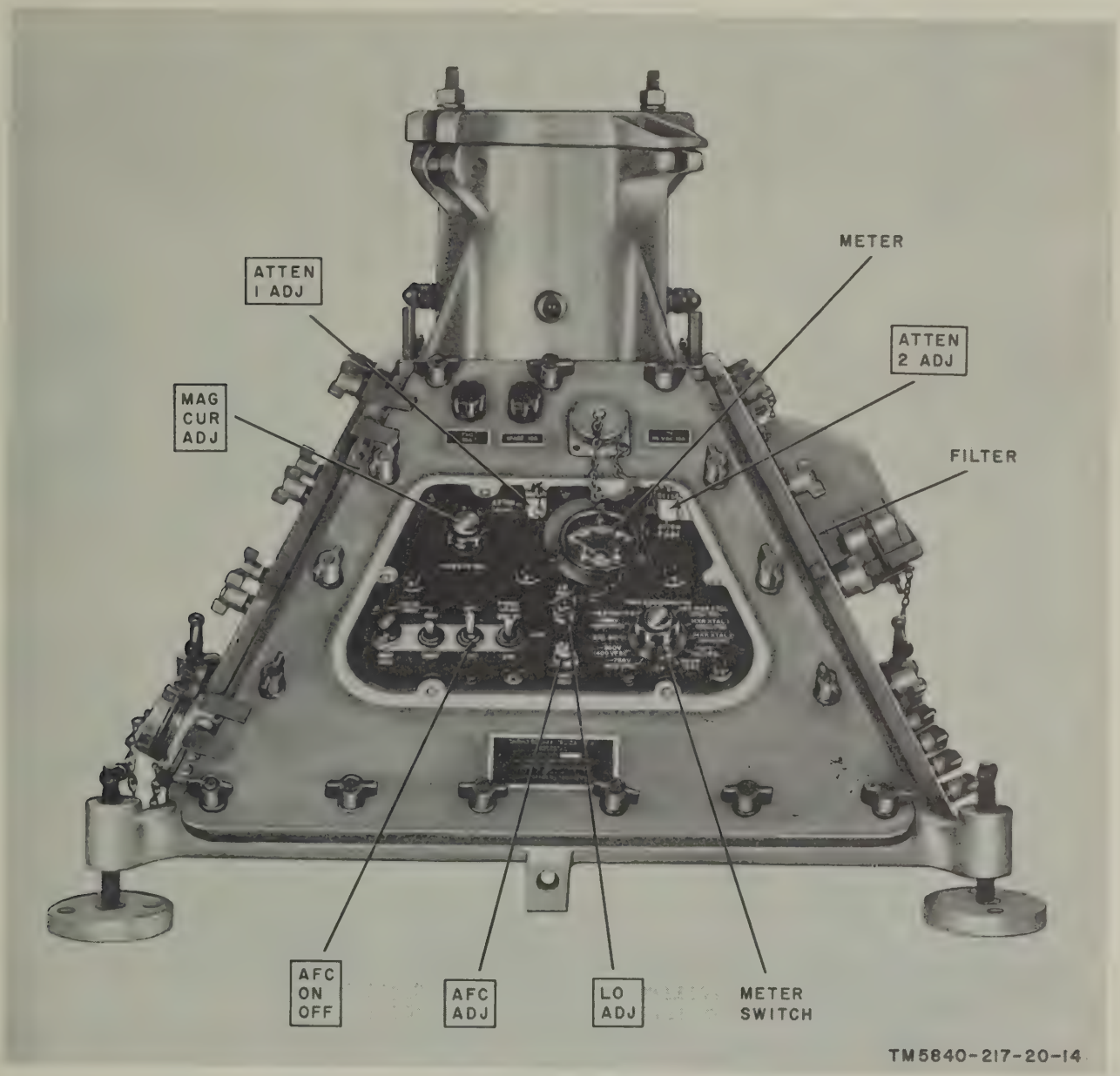


Figure 14. Receiver-transmitter, control locations.

Table I. Receiver-Transmitter Meter Indications

Notes.

1. See that the RADIATE indicator lamp on the radar set control unit is lighted; if the indicator does not light and stay lighted, refer to the equipment performance check list (par. 13, step 22).

2. See that the meter on the coordinator front panel indicates 115-volts; if incorrect, adjust engine generator output (TM 11–6115–203–12).

3. Start at the beginning of the table and obtain each reading in order. If an abnormal indication is obtained, follow the *remedial procedure* before proceeding to the next meter switch position. If trouble persists after the remedial procedures are performed, higher echelon maintenance is required.

4. A list of fuses, their rating, and location is given in TM 11–5840–217–10.

Caution: **Replacement of certain tubes may cause damage to the radar set or effect its alignment. Refer to paragraph 15*b* for a listing of the tubes and circuits affected by replacement of critical tubes.**

Meter switch (fig. 14) position	Meter (fig. 14)			Unit responsible for abnormal indication	Remedial procedures
	Normal indication	Abnormal indication	Additional indications		
−750V (800V FS)	0.79 (630 volts) to 1 (800 volts).	No indication (0 volt)	−300V +150V and −6.3V meter switch positions give no indication.	Power supply Receiver-transmitter	Check fuse F1802. Check fuse F401.
		Less than 630 volts		Receiver-transmitter	Higher echelon maintenance required.
−300V (400V FS)	0.63 (255 volts) to 0.86 (345 volts).	Less than 255 or more than 345 volts.		Receiver-transmitter	Higher echelon maintenance required.
+150V (200V FS)	0.62 (128 volts) to 0.86 (172 volts).	Less than 128 or more than 172 volts.		Receiver-transmitter	Higher echelon maintenance required.
−6.3V (10V FS)	0.53 (5.3 volts) to 0.73 (7.3 volts).	0 to 5.3 volts		Receiver-transmitter	Check tubes V107* and V108* on IF amplifier chassis (fig. 15).
		More than 7.3 volts		Receiver-transmitter	Higher echelon maintenance required.
−27V (40V FS)	0.57 (23 volts) to 0.78 (27 volts).	Less than 23 or more than 27 volts.		Power supply	Higher echelon maintenance required.
MAG CUR (20 MA FS).	0.70 (14 ma)	No indication (0 ma)	AFC AM, AFC MXR XTAL, MXR XTAL 1, and MXR XTAL 2 positions give sweeping indications.	Modulator	Check fuse F502 and tubes V501, V502, and V503* (fig. 17).
		More or less than 14 ma		Transmitter-receiver	Adjust MAG CUR ADJ control (fig. 14) for meter reading of .70.
AFC AM	Steady reading 0.2 to 0.9	No indication	AFC MXR XTAL, MXR XTAL 1, and MXR XTAL 2 positions give no meter indications.	Transmitter-receiver	Check tube V206* on afc amplifier chassis (fig. 16).

		Sweeping indication	AFC MXR STAL, MXR XTAL 1, and MXR XTAL 2 positions give sweeping meter indications.	Transmitter-receiver	Check tubes V201*, V202*, V203*, V204*, and V205* on afc amplifier chassis (fig. 16). If good, check CR3. Follow procedure given in paragraph 21.
AFC MXR XTAL	0.337 (0.674 ma) to 0.412 (0.824 ma).	More or less than normal	MXR XTAL 1 and MXR XTAL 2 positions read more than normal.	Transmitter-receiver	Adjust ATTEN 1 ADJ (fig. 14), using adjustment procedure given in paragraph 22.
MXR XTAL 1 (2 MA FS).	0.337 (0.674 ma) to 0.412 (.824 ma).	More or less than normal	MXR XTAL 2 position reads .75 ma or higher.	Receiver-transmitter	Check CR1 (fig. 24), follow procedure given in paragraph 21. If good, adjust ATTEN 2 ADJ (fig. 14), using procedure given in paragraph 22.
MXR XTAL 2 (2 MA FS).	0.337 (0.674 ma) to 0.412 (0.824 ma).	More or less than normal	----------	Receiver-transmitter	Check CR2 (fig. 24), follow procedure given in paragraph 21. If good, adjust ATTEN 2 ADJ (fig. 14), using procedure given in paragraph 22.

* Refer to paragraph 15 before replacing tube.

Table II. Power Supply Test Point Voltages

Notes.

1. The location of fuses and their ratings are given in TM 11–5840–217–10.
2. If remedial procedures below fail to correct the abnormal indication, or if other abnormal indications are received, refer to higher echelon maintenance.

TP1801 (fig. 5) pin No.		Multimeter		Meter reading (volts)	Tolerance ±(volts)	Abnormal indication	Remedial procedures
Positive lead to	Negative lead to	Selector switch	Range				
J	L	Ac volts	250 v ac	115	5	0 v ac	Check fuses F1801 and F1805.
						Above 120 v ac or below 110 v ac.	Adjust engine generator output (TM 11–6115–203–12).
K	L	Ac volts	250 v ac	115	5	0 v ac	Check fuses F1801 and F1804.
B	C	20,000 ohms per v dc direct.	10 v dc	6.3	.6	0 v dc	Check fuse F1804.
L	A	20,000 ohms per v dc direct.	50 v dc	27	3	0 v dc	Check fuses F1804 and F1806.
L	D	20,000 ohms per v dc direct.	250 v dc	108	11	0 v dc	Check fuse F1805.
						Above 119 v or below 97 v dc.	Check tube V1810 (fig. 21).
E	L	20,000 ohms per v dc direct.	250 v dc	150	15	0 v dc	Check fuses F1804 and F1805 and tube F1806.
						Above 165 v dc or below 135 v dc.	Check tubes V1805 and V1806 (fig. 21).
G	L	20,000 ohms per v dc direct.	250 v dc or 500 v dc, if required.	250	25	0 v dc	Check fuses F1804 and F1805 and tube V1806 (fig. 21).
						Above 275 v dc or below 225 v dc.	Check tube V1806 (fig. 21).
F	L	20,000 ohms per v dc direct.	500 v dc	258	25	0 v dc	Check fuses F1804 and F1805 and tube V1807 (fig. 21).
						Above 283 v dc or below 233 v dc.	Check tubes V1807, V1808, and V1809 (fig. 21).
H	L	20,000 ohms per v dc direct.	500 v dc	318	30	0 v dc	Check fuses F1804 and F1805 and tube V1807 (fig. 21).
						Above 348 v dc or below 288 v dc.	Check tube V1807 (fig. 21).

12. Reference Data

The following chart provides figure reference data to identify and locate parts mentioned in the equipment performance check list.

Note. The complete block diagram (fig. 37) is a valuable supplement when used in conjunction with the equipment performance check list.

Unit	Reference designation	Type of data	Figure No.	
			TM 11-5840-217-10	TM 11-5840-217-20
Antenna	1901–1999	Unit location	1	
		Cable connections	60 or 62	
Coordinator	601–1099	Unit location	5	
		Fuse locations	6	
		Cable connections	60 or 62	
		Line voltage meter	65	
		Chassis locations		23
		Servo control locations		25
		Tube location diagram, range scope and audio chassis.		18
		Tube location diagram, servo amplifier chassis		19
Engine generator	See TM 11–6115–203–12.	Unit location	1	
		Cable connections	60 or 62	
Heater	See technical manual packed with equipment.	Unit location	5	
		Fuse locations	14	
		Control locations	70	
		Cable connections	60	
Modulator	501–599	Unit location	55	
		Fuse locations	10	
		Cable connections	60 or 62	
		Tube location diagram		17
Plotting board	2401–2499	Unit location	5	
		Cable connections	60 or 62	
		Indicator light location		27
Power supply	1801–1899	Unit location	5	
		Fuse and pilot light locations	9	
		Operator's controls	66	
		Cable connections	60 or 62	
		Test point location		5
		Tube location diagram		21
Radar set control	1101–1799	Unit location	5	
		Operator's controls	64	
		Fuse location	8	
		Cable connections	60 or 62	
		Tube location diagram		20
		Adjustment control locations		26
Receiver-transmitter	1–499	Unit location	55	
		Fuse and pilot light locations	11	
		Metering and adjustment control locations		14
		Cable connections	60 or 62	
		Component locations		22
		Tube location diagram, IF amplifier		15
		Tube location diagram, afc amplifier		16
		Mixer crystal locations		24
Shelter	2601–2799	Unit location	1	
		Cable connections	60	
		Operator's controls	71	
		Replacement of overhead lights		12

13. Equipment Performance Checklist

a. General. The equipment performance checklist (*c* below) is a step-by-step procedure for localizing trouble in the radar set. It is used as a preventive maintenance check and also as an alternate troubleshooting procedure when trouble cannot be located by means of the tube troubleshooting chart (par. 14). It is based on the starting, operating, and testing procedures. When using the checklist, set all controls normally off as instructed in paragraph 85, TM 11–5840–212–10, then start at the beginning and follow each step in sequence. If an abnormal indication is obtained, follow the procedures given in the *Corrective measures* column before proceeding to the next step. All the corrective measures which the second echelon repairman can perform are given in this column. If the corrective measures prescribed do not produce the normal indications given, repair or adjustment by higher echelon maintenance is required. Note on the repair tag (if the equipment is turned in for repair) what abnormal indications were present and what corrective measures were taken. Refer to paragraph 12 for the location of parts and controls mentioned in the checklist. Removal and replacement procedures for the indicator lamps mentioned in the *Corrective measures* column are given in paragraph 26 of this manual. The location of fuses used in the equipment are given in paragraph 103 of TM 11–5840–217–10. Continuity checking procedures for cables, mentioned in the *Corrective measures* column of the checklist, are given in paragraph 20 of this manual.

b. Checklist.

Caution: **Violent oscillations may cause damage to the equipment or misalinement may result when a tube, marked with footnote *a* on the following checklist is replaced in the equipment. Before replacing tubes marked with footnote *, read paragraph 15.**

Phase	Step	Unit	Action	Normal indication	Corrective measures
Preparatory	1		Check to see that all cables are correctly connected and not damaged (TM 11–5840–217–10, par. 60 or 62).		
	2		Check to see that covers on the shelter ventilating ports (TM 11–5840–217–10, par. 88), and the heater exhaust port (TM 11–5840–217–10, par. 63) are open.		
	3		Be sure that air intake and exhaust port covers on the individual units are open (TM 11–5840–217–10, par. 46).		
	4		Be sure that the gasoline fuel tank for the heater is full (TM 11–5840–217–10, par. 46*e*).		
	5		Make certain that the plotting board is mechanically coupled correctly (TM 11–5840–217–10, par. 54).		
	6		Set all controls to the prestarting position (TM 11–5840–217–10, par. 80).		

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Preparatory	7	----------	Be sure that the engine generator fuel tank is full and that the controls are in prestarting positions (TM 11–6115–203–12).		
	8	----------	See that interlocks are closed on all units by checking panel latches and wing bolts for tightness.		
Start	9	Engine generator.	Start the engine generator and adjust the output for approximately 115 volts. (TM 11–6115–203–12).	Engine generator operates and adjusts correctly.	See TM 11–6115–203–12.
	10	Shelter----------	Turn MAIN circuit breaker (CB2601), SHELTER circuit breaker (CB2603), FANS (S2601 and S2606), and LIGHTS (S2602) to ON positions.	Shelter ventilator motors operate and overhead lamps light.	If motors operate and lamps do not light, check to be sure that interlocks on shelter doors are closed. If closed, replace lamps (B, fig. 12). Follow procedure given in paragraph 26*a*. If motors do not operate and lamps do not light, check cables W2813 and W2814 between engine generator and shelter. Be sure that circuit breakers are holding (turn off and then on) and that engine generator output is correct.
	11	Heater----------	Turn HEATER switch (S2603) to ON position and HI-OFF-LO switch on the heater to HI position. Turn INCREASE control to the heater full cw. If combustion does not start within 45 seconds, press COLD START switch down.	Observe that glow plug heats and that combustion starts through sight tube.	Check input cable W2603 to heater. If good, refer to heater manual.
	12	Power supply--	Press the RADAR circuit breaker (CB2602) in shelter distribution box and the ON-OFF switch on power supply unit to ON positions. Turn coordinator unit METER LIGHT switch on.	Indicator lamp on power supply and meter on coordinator light. Meter reads 115 volts.	If power supply indicator lamp does not light, check the circuit breaker (turn off and then on), cable W2602 to J1802 on power supply, and fuse F1801 in power supply. If both are good, replace lamp. If meter on coordinator does not read and meter lamps do not light, check cable W2812 between power supply and coordinator units and cables W2808 and W2809 between the coordinator and radar set control units.

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
					If meter does not read exactly 115 volts, adjust output of engine generator (TM 11–6115–203–12) for correct reading. If either meter light fails to light, replace lamp. Follow procedure given in paragraph 17*b* to gain access to lamps. If both meter lights fail to light, check fuse F1005 in coordinator unit.
Start				Blower motor in power supply operates.	Check fuse F1804 in power supply unit.
				Blower motor in coordinator unit operates if surrounding temperature is above −13° F. (−25° C.).	Check fuse F1002 in coordinator unit.
				Blower motor in radar set control unit operates.	See that MAP ZERO switch is in OP position and check fuse F1601; both are in radar set control unit.
				Blower motor in receiver-transmitter unit operates.	Check fuse F1802 in power supply unit and fuse F402 in receiver-transmitter unit. If good, check cable W2601 between coordinator and shelter distribution box and cables W2804, W2805, and W2806 between shelter and receiver-transmitter unit.
				Blower motor in modulator unit operates.	Check fuse F501 in modulator unit and cable W2803 between modulator and receiver-transmitter units.
Equipment performance	13	Radar set control.	Place AUTO-MAN switch in position 3. Rotate PANEL control clockwise and counterclockwise.	Edge lights on radar set control panel and plotting board indicator; light brightens and dims as control is turned cw and ccw respectively.	If all edge lights on radar set control unit do not light, check cable W2809 between radar set control and coordinator units. If some edge lights light, replace those that fail to light. Replace plotting board indicator lamp if it fails to light. Follow procedure given in paragraph 26*b*. If still out, check cable W2810 between plotting table and radar set control.
	14	Receiver-transmitter.	Throw PANEL LIGHT switch to DIM and then to BRIGHT positions.	Edge lights on front panel light.	If all fail to light, check fuse F401. If some fail to light, replace edge lights.
	15	Power supply	Check voltages at TEST point TP1801 (fig. 5) on front panel of power supply; use multimeter.	See table II	See table II.

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Equipment performance	16	Radar set control.	Select any azimuth position within sector of interest at 800 mils from a cardinal point: 800, 2,400, 4,000, or 5,600 mils. Set ELEVATION counter to 0 and RANGE counter to 18,000 meters. Rotate RANGE crank 1 turn ccw.	RANGE, X and Y digital counters move and plotting board indicator light moves in range as RANGE crank is rotated.	If counters do not move and ELEVATION WARNING indicator light flashes, check fuses F1004 and F1006 in coordinator unit. If all counters and the plotting board indicator light do not move, check fuse F1003 in coordinator unit; if good, check tubes V1101* and V1102* (fig. 20), cables W2807, W2808, and W2809 between radar set control and coordinator units, and cable W2812 between power supply and coordinator units. If X and Y counters move, but RANGE counter and plotting board indicator light does not, check tubes V816*, V817*, V818*, and V819* (fig. 19). If the plotting board indicator light and RANGE counters move but both X and Y counters do not, check tubes V1103* and V1104* (fig. 20). If RANGE and X counters and plotting board indicator light operates, but Y counter does not, check tubes V812*, V813*, V814*, and V815* (fig. 19). If all except the X counter operate, check tubes V804*, V805*, V806*, and V807* (fig. 19). If one of the counters (RANGE, X or Y) runs to either limit, check the tubes* of the corresponding servo amplifier (fig. 19).

*Refer to paragraph 15 before replacing tube.

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Equipment performance	17	Radar set control.	Declutch plotting board (TM 11–5840–217–10, par. 67*a*). Rotate AZIMUTH crank through 6,750 mils clockwise and counterclockwise.	Azimuth digital counter follows as crank is rotated, X and Y counters move, AZIMUTH WARNING indicator lights with flashing indication at both limits only.	If AZIMUTH WARNING indicator does not light at either limit, replace indicator lamp. If still inoperable, check cable W2808 between radar set control and coordinator units, cable W2601 between coordinator unit and shelter distribution box, cables W2804, W2805, and W2806 between shelter distribution box and receiver-transmitter unit and cable W2801 between receiver-transmitter and antenna assembly. If the AZIMUTH WARNING indicator lights steadily at all counter readings, check fuse F403. If good, check tubes V808, V809*, V801*, and V811* (fig. 19).
	18	Radar set control.	Engage plotting board clutch, orient with sector of interest (TM 11–5840–217–10, par. 67). Rotate AZIMUTH crank until indicator arm is in mid-position or sector of interest. Orient SECTOR CENTER control (TM 11–5840–217–10, par. 68). Select position 1 of AUTO-MAN switch. Turn SECTOR WIDTH switch to 540 mil position; after checking azimuth travel, turn to 360 mil position.	CW and CCW indicator lamps light alternately, as the AZIMUTH counter runs in the indicated direction. AZIMUTH digital counter reads ±180 (+18, −2) mils (from selected azimuth position) in 360 position of SECTOR WIDTH switch and ±270 (+22, −3) mils in 540 mil position. Plotting board indicator arm follows changes in azimuth, X and/or Y counter readings change. AZIMUTH crank does not move.	If counters and plotting board indicator arm indicate correctly, but CW and CCW indicator lamps do not light, be sure that panel control is full clockwise. If either or both indicators still fail to light, replace lamps.

*Refer to paragraph 15 before replacing tube.

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Equipment performance	19	Radar set control.	Select position 3 of AUTO-MAN switch. Remove and replace fuse F402. Turn ELEVATION crank through the PLUS and MINUS mechanical limits of ELEVATION digital counter.	ELEVATION and AZIMUTH WARNING indicators light steadily, with fuse F402 removed, and do not light when fuse is replaced. ELEVATION, RANGE, X and Y counters move and antenna motion is heard (with ear pressed against antenna mast) as ELEVATION crank is rotated.	If ELEVATION WARNING indicator does not light with fuse F402 removed, check fuse F403, then replace indicator lamp. If ELEVATION WARNING indicator lights with flashing indication, or antenna motion is not heard, check tubes V801*, V802*, and V803* (fig. 19). If tubes are good, check cable W2808 between radar set control and coordinator unit, cable W2601 between coordinator unit and shelter distribution box, cables W2804, W2805, and W2806 between shelter distribution box and receiver-transmitter unit and cable W2801 between receiver-transmitter unit and antenna assembly.
	20	Radar set control.	Set ELEVATION digital counter to 0, MAP SCALE switch to 1:25K position and RANGE counter to 18,000 meters. Turn MAP SCALE switch to 1:50K position.	RANGE counter reads 18,000 ±75 meters with MAP SCALE in 1:50K position.	Adjust SCALE ADJ (R1409), follow procedure given in paragraph 24.
	21	Radar set control.	Be sure that X and Y digital counters are properly oriented with AZIMUTH counter (par. 64*d*(6), TM 11–5840–217–10). Turn MAP SCALE switch to 1:25K position. Set RANGE digital counter to 18,000 meters and AZIMUTH counter to 800 mils. Turn ELEVATION crank until counter reads plus 178 mils.	RANGE counter reads 17,726 ±75 meters. X and Y counters read 12,548 ±140 meters.	If X and/or Y counters do not read within tolerance, adjust X and Y calibrating controls; follow procedure given in paragraph 25.

*Refer to paragraph 15 before replacing tube.

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Equipment performance	22	Radar set control.	Five or more minutes after turning power supply ON-OFF switch to ON position, press RADIATE switch to ON position.	RADIATE indicator lamp lights as switch is pressed to ON and remains lighted after switch is released.	If the RADIATE indicator does not light, replace lamp. If the indicator lights when switch is pressed, but does not remain lighted when switch is released, wait 5 minutes and press switch again. If still inoperative, check cable W2808 between radar set control and coordinator units, cable W2601 between coordinator unit and shelter distribution box, cables W2804, W2805, and W2806 between shelter distribution box, and receiver-transmitter unit, cable W-2802 between receiver- transmitter and modulator units and cable W2801 between receiver-transmitter unit and antenna assembly.
	23	Receiver-transmitter.	Select positions of meter switch (fig. 14).	See table I	See table I.
	24	Antenna	Be sure that antenna is level.	Leveling lights (fig. 11, TM 11–5840–217–10) do not light.	See paragraph 64*d*(12), TM 11–5840–217–10.
	25	Antenna	Be sure that antenna is oriented properly with sector of intrest (par. 66, TM 11–5840–217–10).		

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Equipment performance	26	Radar set control.	Turn AUTO-MAN switch to position 1 and 2 in order.	Range gate travels across scope screen from left to right in both positions of AUTO-MAN switch.	If scope is blank, check fuse F1001 in coordinator unit. If fuse is good, check to see that scope controls (VERTICAL, INTENSITY and SCOPE GAIN) are set correctly. If controls do not correct the condition, check tubes V601,* V602,* V603,* V605,* V606,* V607,* V608,* and V609* (fig. 18). If tubes are good, check cables W2807 and W2809 between radar set control and coordinator units, cable W2601 between coordinator unit and shelter distribution box, cables W2804, W2805, and W2806 between shelter distribution box and receiver-transmitter unit. If a bright dot or vertical line appears on the right side of the scope, check tubes V603,* V607,* V609,* and V610* (fig. 18). If the above tubes are good and scope is still blank, or if the sweep is present with very poor intensity and the range gate is missing, check tubes V615,* V616,* V618,* V619,* and V620* (fig. 18). If the sweep and range gate are present with poor intensity, check tube V614* (fig. 18). If a sweep is present with normal intensity, but the range gate is missing, check tubes V613 and V621 (fig. 18) and tubes V1105, V1106, and V1107 (fig. 20). If sweep and range gate are present, but range gate is not traveling across scope face, check cable W2808 between radar set control and coordinator units.

*Refer to paragrapn 15 before replacing tube.

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Equipment performance	27	Radar set control.	Select position 3 of AUTO-MAN switch. Train antenna on moving target with RANGE AZIMUTH and ELEVATION cranks (TM 11–5840–217–10, par. 83).	Range gate stationary at left side of scope. Moving target superimposed on nearest target at right edge of range gate. Other fixed targets (within 1,000 meters, outward of range setting) shown across scope face. Moving target heard on the loudspeaker and/or headsets.	If fixed targets can be seen on scope, but moving target cannot be heard, check to see that VOLUME and RCVR GAIN controls on radar set control unit, and SPEAKER VOLUME control on loudspeaker are turned up (cw). If audio is still missing, check tubes V621, V622,* V623, V624, V625, and V626 (fig. 18). If targets can neither be seen nor heard, check tubes V611,* V612,* V614* (fig. 18), and tubes V101,* V102,* V103,* V104,* V105,* V106,* V107,* and V108 (fig. 15). If tubes are good, check cable W2807 between radar set control and coordinator units, cable W2601 between coordinator unit and shelter distribution box, and cables W2804, W2805, and W2806 between the shelter distribution box and receiver-transmitter unit.
	28	Radar set control.	Turn AUTO-MAN switch from position 3 to position 4. Retrack moving target with RANGE, ELEVATION and AZIMUTH cranks for maximum amplitude on scope.	Scope trace disappears momentarily during beam switching (position 3 to 4 of AUTO-MAN switch). At completion of beam switching, audio from moving target is heard on loudspeaker and/or headsets and audio signal is seen on scope.	If tracking is broad for peak signals on scope, reduce SCOPE GAIN control just enough to obtain sharp peak with all three cranks.
	29	Radar set control.	Select position 5 of AUTO-MAN switch.	Audio from moving target is heard on loudspeaker and/or headsets. Moving target is seen on scope at right edge of range gate, superimposed on nearest fixed target. Other fixed target (within 1,000 meters outward of range setting) is shown across scope face.	

*Refer to paragraph 15 before replacing tube.

b. Checklist—Continued

Phase	Step	Unit	Action	Normal indication	Corrective measures
Stop	30	----------	Set all controls normally off as instructed in paragraph 85, TM 11–5840–217–10.		
	31	Engine generator.	Turn off engine generator as instructed in TM 11–6115–203–12.	See TM 11–6115–203–12	See TM 11–6115–203–12.

*Refer to paragraph 15 before replacing tube.

Notes.
1. Refer to paragraph 17 for chassis locations and access to tubes.
2. Refer to paragraph 18 for interlock switch locations, and instructions for closing.

14. Tube Troubleshooting Chart

Note. Refer to paragraph 17 for chassis locations and access to tubes.

Symptom	Action or condition	Additional indication	Tubes and location
A-scope blank, no audio	Rotate RANGE hand wheel	RANGE, X and/or Y counter, do not move.	V1805 through V1810 (fig. 21).
	Rotate meter selection switch on receiver-transmitter unit to MAG CUR, AFC AM, AFC MXR XTAL, MRX XTAL 1 and MXR XTAL 2 positions.	No meter indication in MAG CUR position, other switch positions give sweeping indications.	V501, V502, V503* (fig. 17).
		Meter presents correct indications (table I) in all switch positions.	V601*, V602* (fig. 18).
No video or audio target on A-scope, no audio, but sweep and range gate on A-scope.	Rotate meter selector switch to AFC AM, AFC XTAL MXR, MXR XTAL 1 and MXR XTAL 2 switch positions.	AFC AM position gives a normal meter indication (0.2 to 0.9). No meter indications in other switch positions.	V206* (fig. 16).
		All switch positions give sweeping meter indication.	V201*, V202*, V203*, V204*, V205* (fig. 16), CR 3 (fig. 24, par. 21).
		MXR XTAL 1 and/or MXR XTAL 2 switch positions give meter indications of more than 0.824 or less than 0.412. AFC AM and AFC MXR XTAL switch positions give correct indications (see table I).	CR 1, CR 2 (fig. 24, par. 21).
		All meter readings correct	V101*, V102*, V103*, V104*, V105*, V106*, V107, V108 (fig. 15), V611, V612* (fig. 18).
A-scope blank	INTENSITY control in mid-position. All positions of AUTO-MAN switch.	Audio normal	V603*, V605*, V606*, V607*, V608*, V609*, V610* (fig. 18).
No audio, low intensity sweep but no range gate on A-scope.	All positions of AUTO-MAN switch.	Video targets on A-scope in positions 1, 2, 3, and 5 of AUTO-MAN switch.	V615*, V616*, V618*, V619*, V620* (fig. 18).

*Refer to paragraph 15 before replacing tube.

Symptom	Action or condition	Additional indication	Tubes and location
No audio	RCVR GAIN control full clockwise.	Video targets and range gate on A-scope in positions 1, 2, 3, and 5 of AUTO-MAN switch.	V621, V622*, V623, V624, V625, V626 (fig. 18).
RCVR GAIN control does not affect video and audio signals.	RCVR GAIN control rotated through full travel.	Low intensity video targets and range gate on A-scope.	V614* (fig. 18).
No video targets or range gate on A-scope, audio normal.	AUTO-MAN switch in positions 1, 2, 3, or 5.	Sweep on scope, audio present on A-scope in position 4 of AUTO-MAN switch.	V613 (fig. 18).
Sweep on A-scope, but range gate and video targets missing from A-scope.	All positions of AUTO-MAN switch.	Audio normal but no audio signal on A-scope in position 4 of AUTO-MAN switch.	V1105, V1106, V1107 (fig. 20).
Antenna cannot be trained to target in azimuth.	AUTO-MAN switch in position 3. AZIMUTH counter cranked between limits.	AZIMUTH WARNING indicator lights constantly with steady or flashing indication; antenna rotation is not heard (with ear pressed against antenna mast).	V809*, V810*, V811 (fig. 19).
	AZIMUTH counter cranked well past either limit.	AZIMUTH WARNING indicator either lights with flashing indication or does not light.	V808 (fig. 19).
Antenna cannot be trained to target in elevation.	ELEVATION counter cranked between mechanical limits.	ELEVATION WARNING indicator either lights constantly with flashing indication or does not light; antenna motion not heard (with ear pressed against antenna mast).	V801*, V802*, V803* (fig. 19).
RANGE, X and/or Y counters do not move.	RANGE and ELEVATION cranks rotated.	Audio and A-scope presentation normal. Plotting board indicator light does not move.	V1101*, V1102* (fig. 20).
RANGE counter does not move.	RANGE crank rotated	X and/or Y counters move	V816*, V817*, V818*, V819* (fig. 19).
X and Y counters do not move.	RANGE and AZIMUTH cranks rotated.	RANGE counter and plotting board indicator light moves.	V1103*, V1104* (fig. 20).
X counter does not move	AZIMUTH, ELEVATION and RANGE cranks rotated.	Plotting board indicator light and RANGE and Y counters move.	V804*, V805*, V806*, V807* (fig. 19).
Y counter does not move	AZIMUTH, ELEVATION and RANGE cranks rotated.	Plotting board indicator light and RANGE and X counters move.	V812*, V813*, V814*, V815* (fig. 19).

*Refer to paragraph 15 before replacing tube.

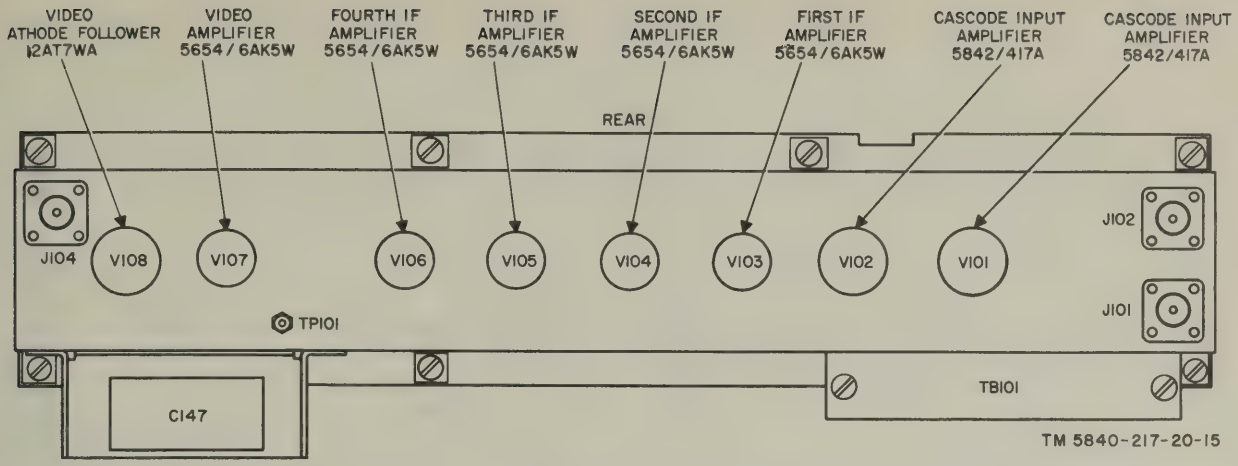


Figure 15. Radar Receiver-Transmitter RT–500/TPS–25, signal IF amplifier chassis, tube location diagram.

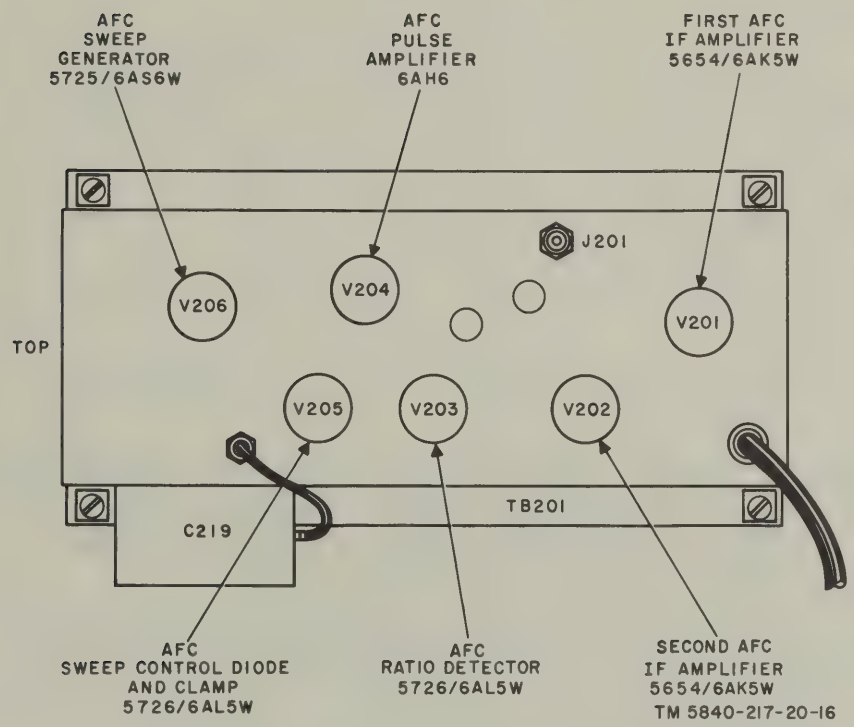


Figure 16. Radar Receiver-Transmitter RT–500/TPS–25, AFC amplifier chassis, tube location diagram.

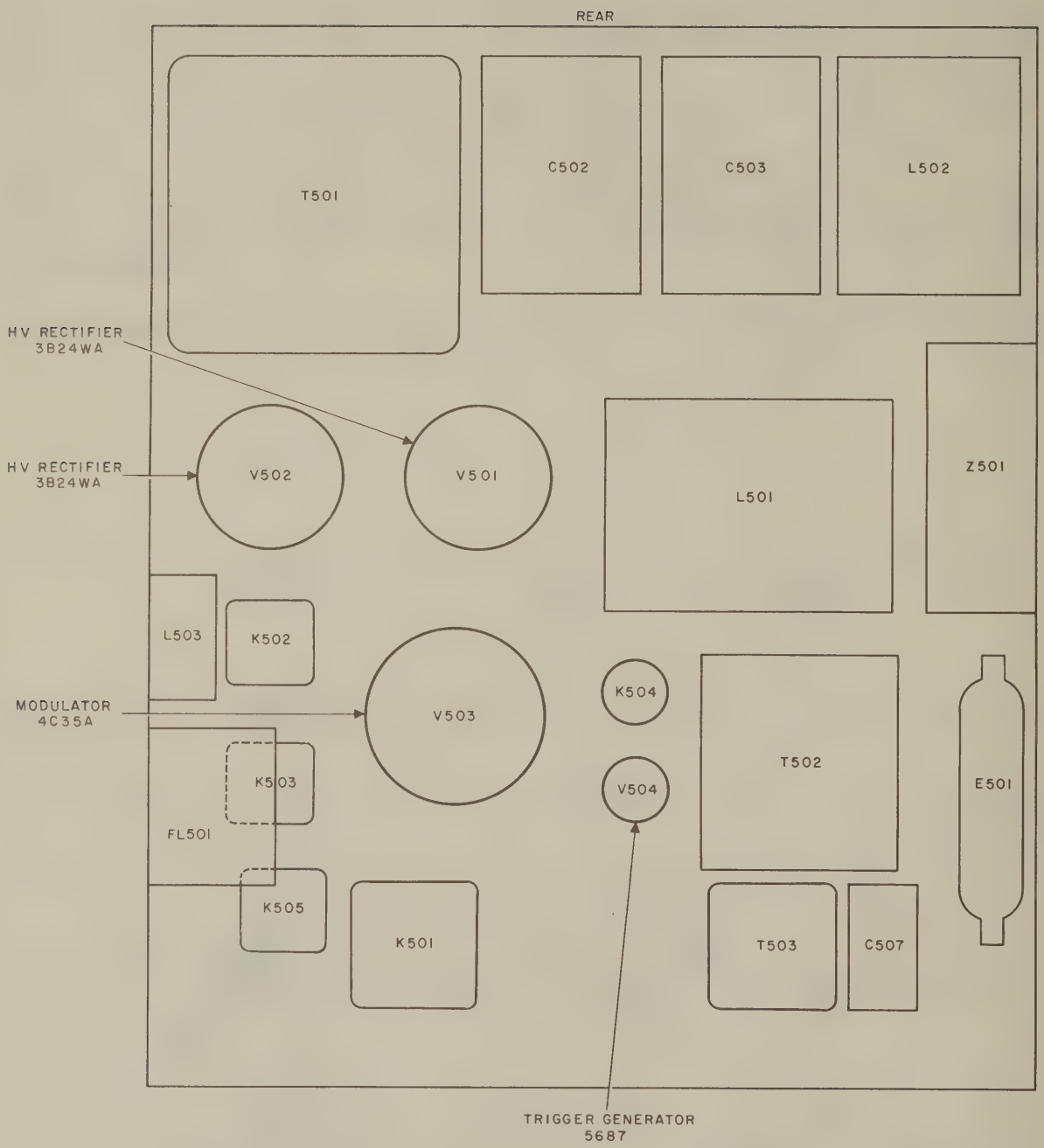


Figure 17. Radar Modulator MD–344/TPS–25, tube location diagram.

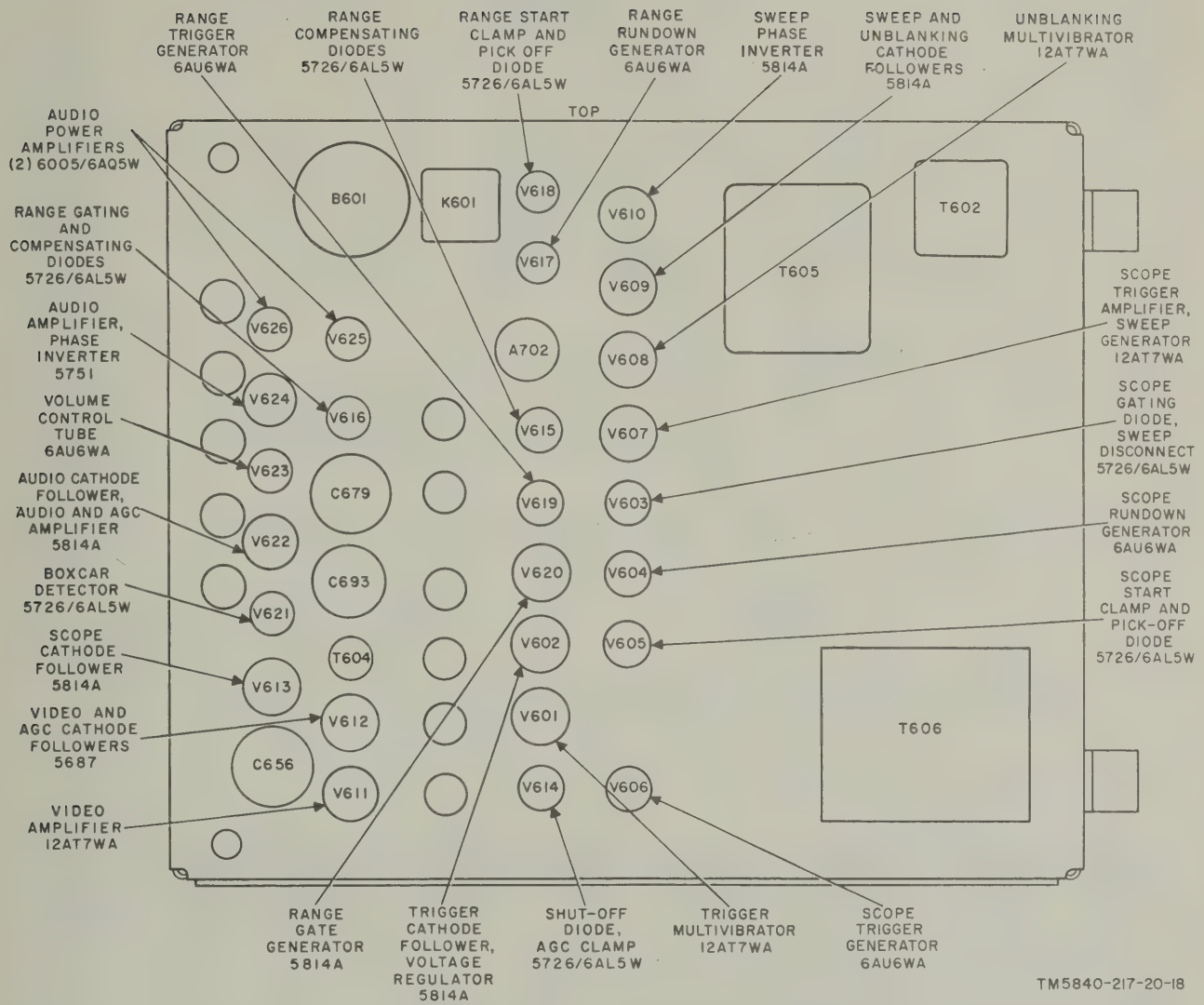


Figure 18. Servo Data Coordinator SN–231/TPS–25, range, audio and scope chassis, tube location diagram.

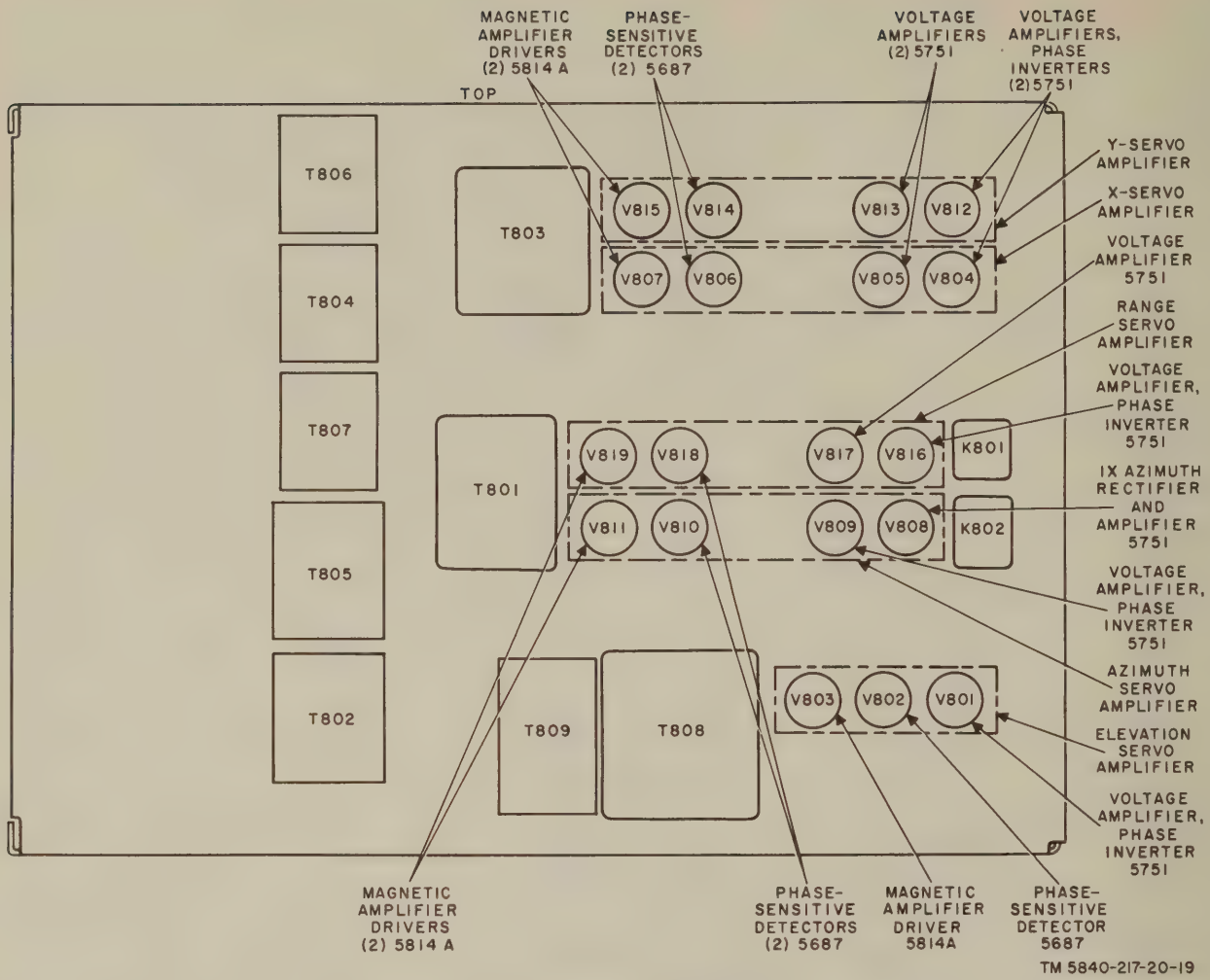


Figure 19. Servo Data Coordinator SN–231/TPS–25, servo amplifiers chassis, tube location diagram.

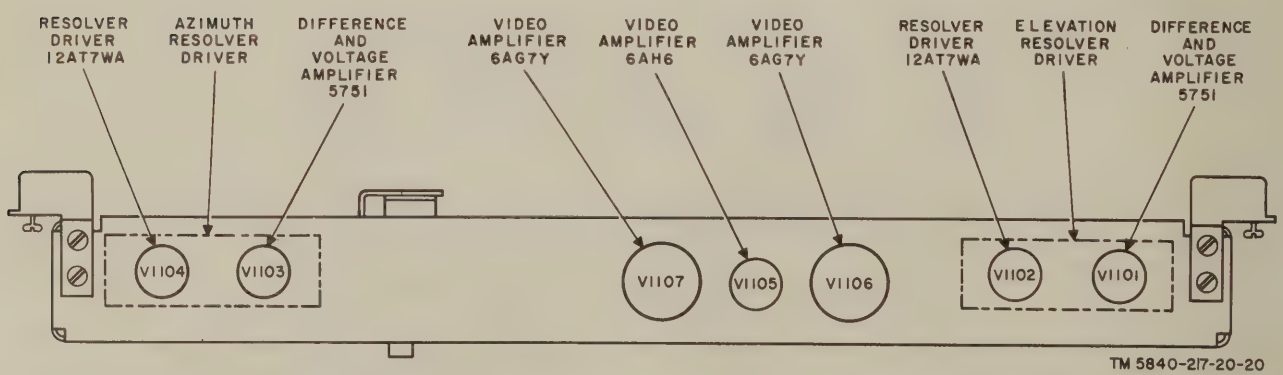


Figure 20. Radar Set Control C–2715/TPS–25, resolver drivers and video amplifier chassis, tube location diagram.

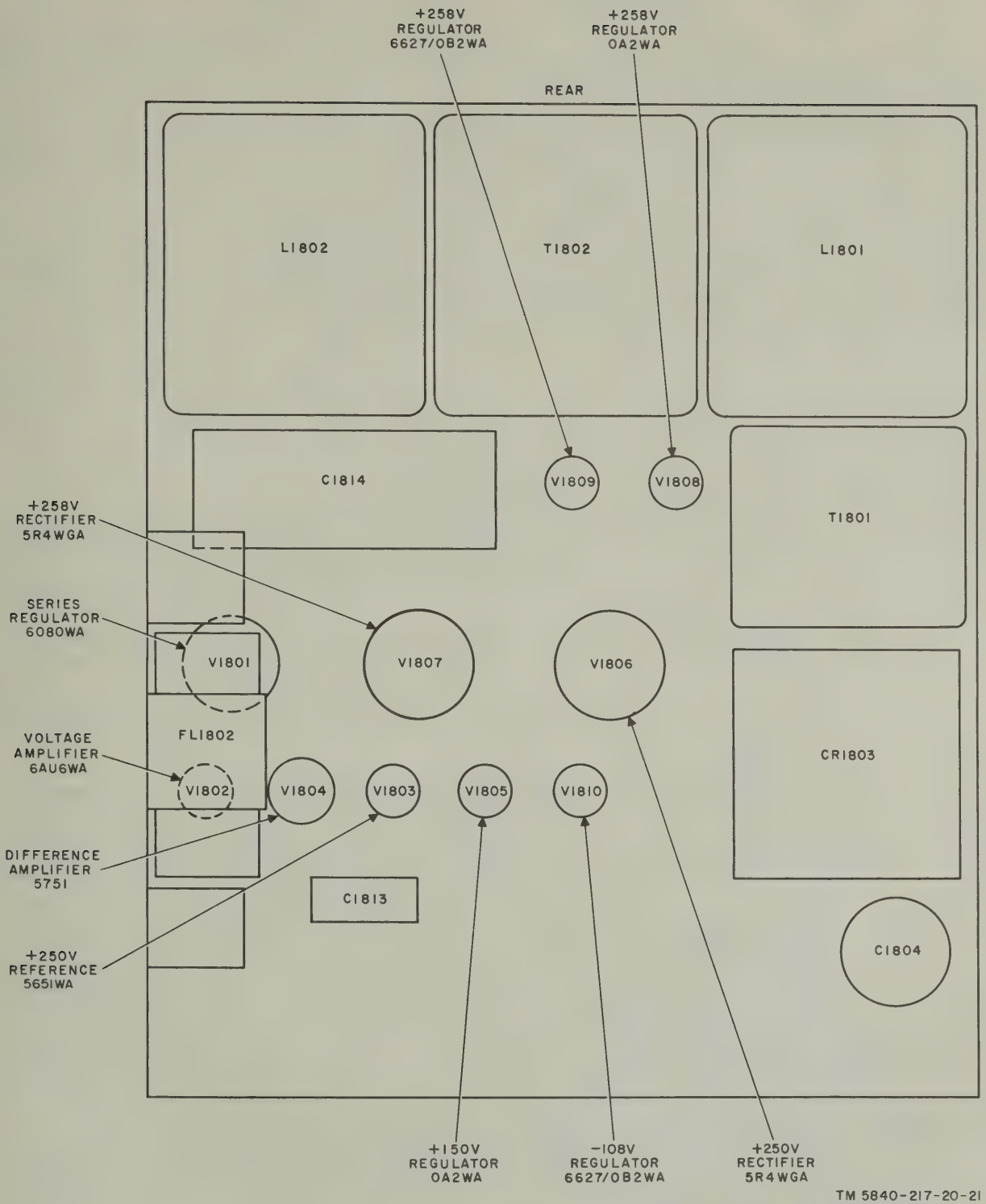


Figure 21. Power Supply PP–2166/TPS–25, tube location diagram.

15. Replacement of Tubes Causing Equipment Damage or Possible Misalinement

Caution: **Circuit realinement of the radar set, by a higher echelon repairman, is required, as soon as possible if any of the tubes listed in *b* below is replaced. Be careful when replacing tubes in the elevation servo amplifier, X servo amplifier, azimuth servo amplifier, Y servo amplifier, and range servo amplifier located in the coordinator unit. Violent oscillations in these servo circuits may cause physical damage to mechanical components of the equipment. The oscillations may be caused by differences in tube characteristics which necessitate circuit alinement.**

a. General. Replacement of the tubes listed in *b* below can cause various degrees of the possible misalinement indicated. Organizational maintenance personnel are authorized to replace these tubes listed in *b* below only if a higher echelon repairman is not available and operation of the radar set is necessary. When a tube with the possible misalinement of range accuracy is replaced, the radar set will work reasonably well for terrain surveillance, but is not to be relied on for fire control use. Refer to *special notice* column of Critical Tube List, subparagraph *b* below.

b. Critical Tube List.

Symbol	Unit location	Possible misalinement	Special notice
V101 through V106	Receiver-transmitter	Receiver sensitivity.	
V201 through V206	Receiver-transmitter	Receiver sensitivity.	
V503	Modulator	Pulse rate.	
V601, V602	Coordinator	Range accuracy	Replacement not recommended for fire control use.
V603	Coordinator	Scope sweep	Observe if sweep is present on scope. If not, replace with spare tubes until sweep is present.
V605 through V608	Coordinator	Scope sweep	Observe if sweep is present on scope. If not, replace with spare tubes until sweep is present.
V610	Coordinator	Scope sweep	Observe if sweep is present on scope. If not, replace with spare tubes until sweep is present.
V611, V612	Coordinator	Video gain.	
V614, V615, V616	Coordinator	Range accuracy	Replacement not recommended for fire control use.
V618, V619, V620	Coordinator	Range accuracy	Replacement not recommended for fire control use.
V622	Coordinator	Receiver sensitivity	Adjust RCVR GAIN control until video targets on scope are just below saturation.
V801, V802, V803	Coordinator	Elevation servo amplifier.	Listen with ear pressed against antenna mast for antenna oscillations. If antenna is oscillating, reduce EL GAIN control (par. 24) until oscillations just cease.
V804 through V807	Coordinator	X servo amplifier	Observe X digital counters on radar set control. If oscillating, reduce X GAIN control (par. 24) until oscillations just cease.
V809, V810, V811	Coordinator	Azimuth servo amplifier	Listen with ear pressed against antenna mast for antenna oscillations. If antenna is oscillating, reduce AZ GAIN control (par. 24) until oscillations just cease.
V812 through V815	Coordinator	Y servo amplifier	Observe Y digital counters on radar set control. If oscillating, reduce Y GAIN control (par. 24) until oscillations just cease.

b. Critical Tube List—Continued

Symbol	Unit location	Possible misalinement	Special notice
V816 through V819	Coordinator	Range servo amplifier	Observe RANGE digital counters on radar set control. If oscillating, reduce RHO GAIN control (par. 24) until oscillations just cease.
V1101 through V1104	Radar set control	Range accuracy	Replacement not recommended for fire control use.

16. Tube Testing and Replacement

If a tubetester is available, proceed as outlined in *a* below. If a tube tester is not available, proceed as outlined in *b* below; if this procedure fails to clear the trouble, continue with the procedure outlined in *c* below. If the procedures in *b* and/or *c* below are to be followed, refer to paragraph 18 for instructions on closing of interlock switches.

Cautions: **1. Do not rock or rotate the top of a miniature tube when removing it from its socket; pull it straight out. Rocking or rotating the tube causes the pins to bend and may break the weld where the tube enters the glass. A high resistance or intermittent joint may also develop.**

2. Tubes V1, V2, V3, V401 through V405, V504, V604, V617, V1601, and V1801 through V1804 are not to be replaced by the second echelon repairman, as considerable misalinement of the radar set could result.

3. Before replacing any tube, refer to paragraph 15. If the tube to be replaced is listed there, follow the instructions (if any) applicable to that particular tube before returning the set to service. If any tube listed in paragraph 15 is replaced, realinement by higher echelon maintenance is required as soon as possible.

Note. Do not use nonpreferred type tubes in place of preferred types. For example do not use a 6AK5 (nonpreferred) to replace a 5654/6AK5 (preferred). Paragraph 19 lists the *nonpreferred* tube types that *can not be replaced* by a *preferred* type.

a. Using Tube Tester.

(1) Remove and test one tube at a time. If it is necessary to remove more than one tube at a time, label each, so that it can be replaced, if satisfactory, in its original socket.

(2) Replace a tube only when there is an obvious defect, such as a broken glass envelope, open filament, broken lead or connecting prong, or when a test in a tube tester or other equipment shows the tube to be defective.

(3) Do not discard a tube merely because it tests *on or near* the minimum test limit of the tube tester. Some new tubes test near the low end of the acceptable range of the tube specification. These tubes provide satisfactory service over a long period of time, even though they remain at, or near, this low limit value.

(4) Do not discard a tube merely because it has been in use for a specified length of time. *Satisfactory operation in a circuit is final proof of tube quality.*

b. Single-Tube Substitution Method.

(1) Substitute a new tube for one of the suspected original tubes. If the equipment continues to be inoperative, replace the new tube with the original. Similarly, check each original tube suspected, one at a time, until the defective tube is located and the equipment becomes operative. Discard the last original tube removed from the equipment. DO NOT LEAVE A NEW TUBE IN A SOCKET IF THE EQUIPMENT OPERATES SATISFACTORILY WITH THE ORIGINAL TUBE.

(2) If this method of tube substitution does not correct the trouble, try the method described in *c* below.

c. Multitube Substitution Method. When two or more tubes are defective in a piece of equipment, install new tubes, one at a time, until the equipment becomes operative. Proceed as follows:

(1) Remove one of the suspected original tubes. Install a new tube. If the equipment is still inoperative, leave the new tube in place and remove the next sus-

pected original tube. Install another new tube. Mark the original tubes with the socket number from which they were removed. Continue this procedure until the equipment becomes operative. The last original tube removed is defective and should be discarded.

(2) To determine whether another original tube is defective, return one of them to its original socket. If there is no noticeable difference in performance, leave the original tube in the equipment. In the same way, return the remaining original tubes to their sockets, one at a time. If equipment failure occurs, or performance suffers, discard the last original tube installed. DO NOT LEAVE A NEW TUBE IN A SOCKET IF THE EQUIPMENT OPERATES SATISFACTORILY WITH THE ORIGINAL TUBE.

d. Turn-In for Repair. If none of the procedures outlined above restores the equipment to normal operation, *return the original tubes to their sockets* before forwarding the defective item of equipment to a higher echelon for repair.

17. Tube and Chassis Locations

Chassis locations and access to the tubes (that can be changed by organizational maintenance personnel) in the units of Radar Set AN/TPS–25 are explained below.

Note. If power is applied with the unit removed from the case, panel open or cover removed, close the interlock switch (par. 18), reconnect the cables (fig. 60 or 62, TM 11-5840-217-10) if disconnected, operate the ON-OFF switch on the power supply unit to the ON position and after 5 minutes, press the RADIATE switch to the ON position (RADIATE indicator lights and remains lit when switch is released).

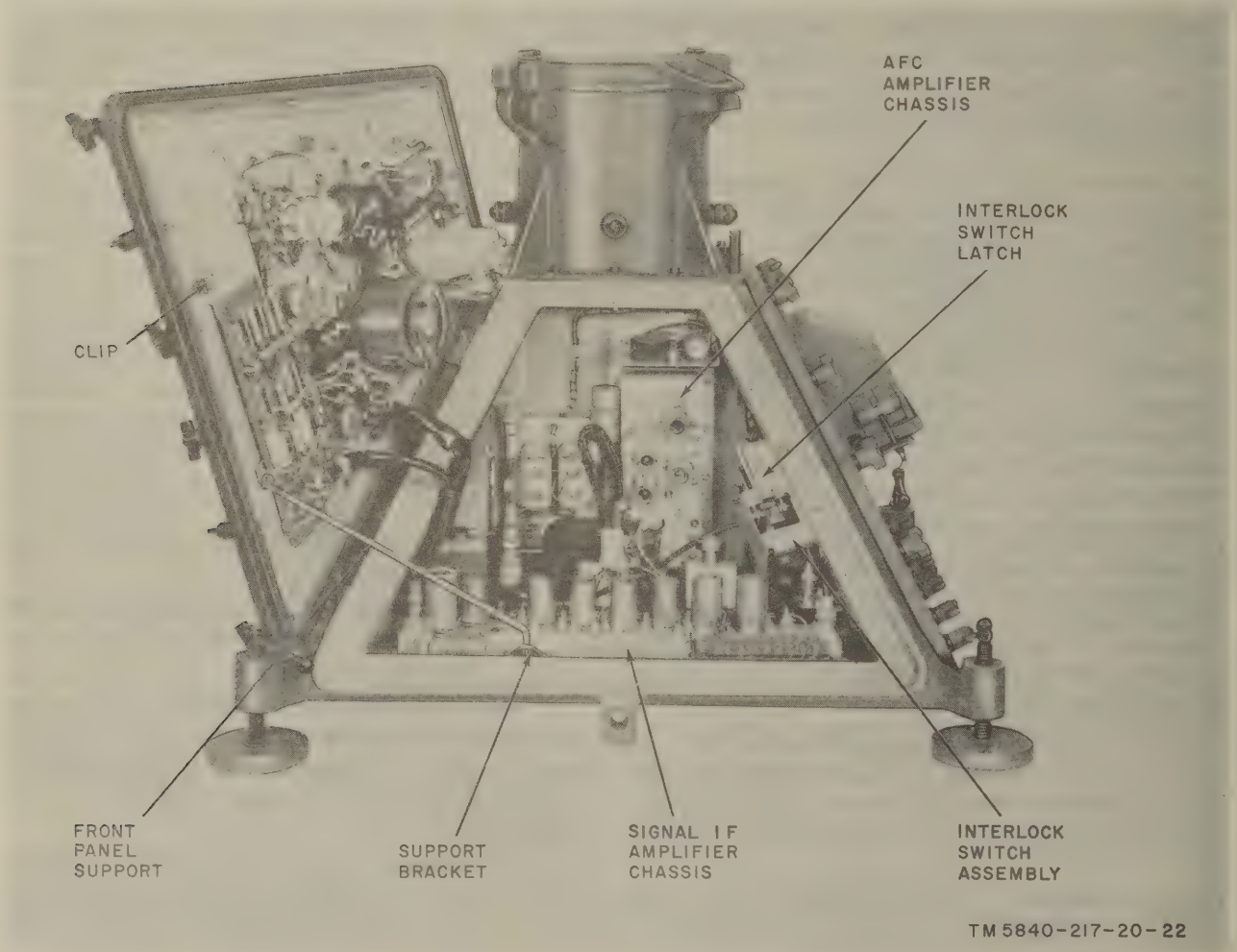


Figure 22. Receiver-transmitter unit, component locations.

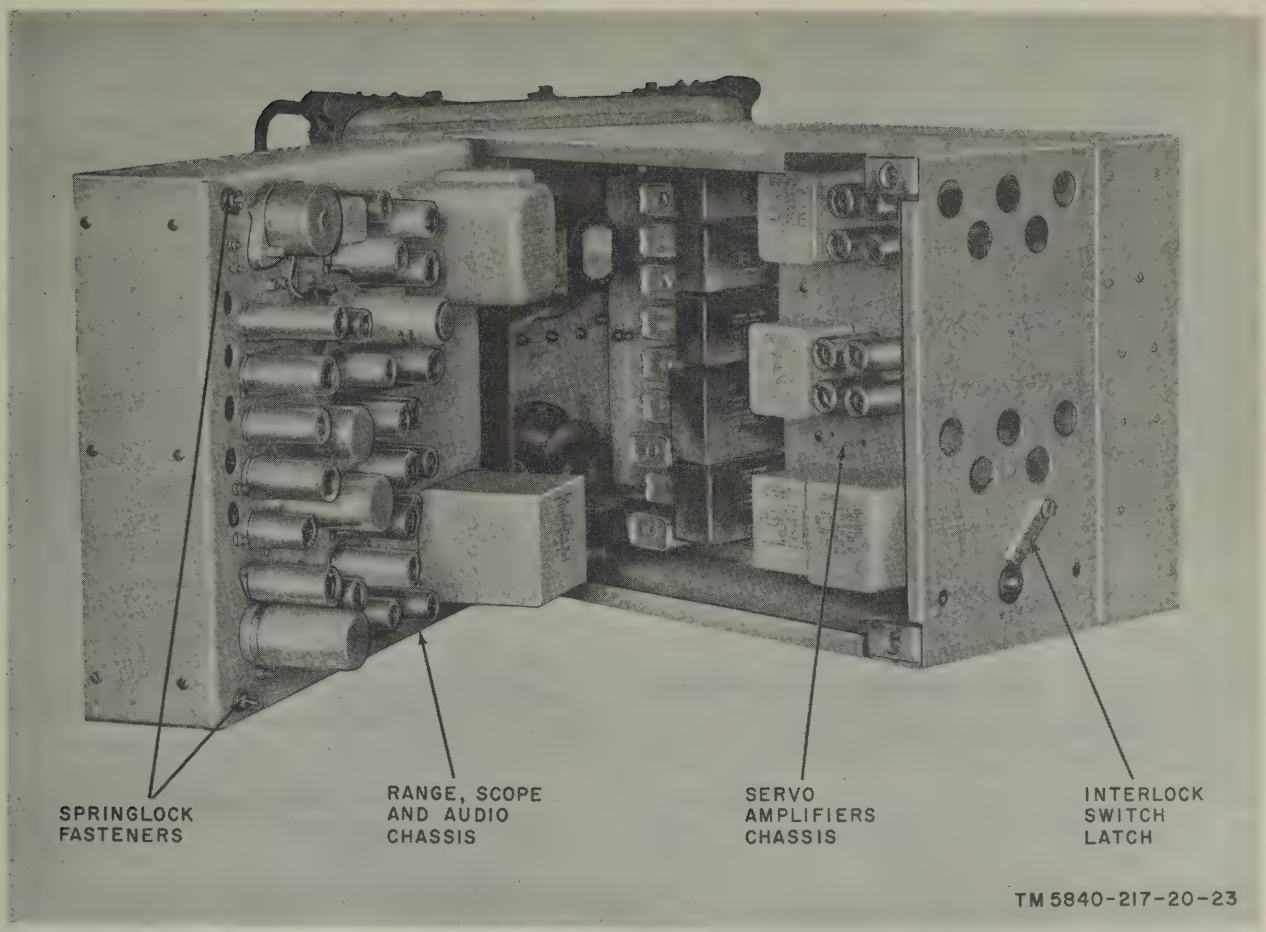


Figure 23. Coordinator unit, component locations.

a. Receiver-Transmitter. Tubes V101 through V108 (fig. 15) on the signal if amplifier chassis (fig. 22) and tubes V201 through V206 (fig. 16) on the afc amplifier chassis (fig. 22) are part of the receiver-transmitter unit. Access to these tubes is gained as follows:

(1) Operate the ON-OFF switch on the power supply unit to the OFF position.
(2) Loosen the 15 captive wing bolts that fasten the front panel.
(3) Open the hinged front panel as far as possible.
(4) Remove the free end of the front panel support from the clip on the front panel and insert it in the hole in the support bracket (fig. 22).

b. Coordinator. Tubes V601 through V626 (fig. 18) on the range, scope, and audio chassis (fig. 23) and tubes V801 through V819 (fig. 19) on the servo amplifiers chassis (fig. 23) are located in the coordinator unit. Access to these tubes is gained as follows:

(1) Operate the ON-OFF switch on the power supply unit to the OFF position.
(2) Remove the connecting cables on the front panel of the unit.
(3) Open the 12 front panel latches and pull the unit out of the case.
(4) Open the two spring lock fasteners (fig. 23) by inserting a screwdriver in the slots of the fasteners (on underside of right side chassis) and turning ½ turn ccw.
(5) Swing hinged right side chassis out.

c. Modulator. Tubes V501 through V504 (fig. 17) are located in the modulator unit (fig. 4). Access to the modulator unit is gained by opening the six front panel latches and pulling the unit out of the case.

d. Radar Set Control. Tubes V1101 through V1107 (fig. 20) on the resolver drivers and video amplifier chassis (fig. 7) are located in the radar set control unit. Access to these tubes is gained as follows:

(1) Operate the ON-OFF switch on the power supply unit to the OFF position.

(2) Remove the back cover of the unit by opening the 10 latches and pulling off the cover.

(3) Open the two spring lock fasteners (fig. 26) and allow the chassis to fall vertical.

e. Power Supply. Tubes V1801 through V1810 (fig. 21) are located in the power supply unit (fig. 5). Access to the power supply unit is gained as follows:

(1) Remove power from the radar set by operating the RADAR circuit breaker on the shelter distribution box to the OFF position.

(2) Remove the connecting cables on the front panel of the unit.

(3) Open the six front panel latches and pull the unit out the case.

18. Locations and Closing of Interlock Switches

To permit tube testing by the substitution methods (*b* and *c*, par. 16) and internal adjustments in the units, apply power with units open. To do this, disable the interlock switches of the opened units.

a. Locations of Interlock Switches. The interlock switches for the coordinator (fig. 23), modulator, and power supply units are located at the rear of the unit and are open when the chassis is removed from the case (par. 17). Three interlock switches are provided on the receiver-transmitter unit: right side, left side, and under the front panel. The only receiver-transmitter interlock switch of concern to the second echelon repairman is the one under the front panel (fig. 22). The interlock switch in the radar set control unit opens when the rear cover of the unit is removed (par. 17).

b. Closing Interlock Switches.

***Warning:* High voltage connections are exposed when the units are open. To avoid injury, do not replace components with the interlock switch closed and power on. When replacing a component in a unit, first remove power from the unit by operating the ON-OFF switch on the power supply unit to the OFF position.**

(1) The interlock switches in the modulator, coordinator, radar set control, and under the front panel of the receiver-transmitter unit are the same type. To close the switch, proceed as follows:

(*a*) Loosen the knurled head screw that holds the free end of the hinged interlock switch latch (fig. 23).

(*b*) Swing the free end of the latch over the switch actuator.

(*c*) Engage the knurled head screw in the threaded hole provided and tighten the screw.

(2) The interlock switch on the power supply unit is closed by pressing down on the switch actuator arm and pressing the hold button (on opposite end) at the same time. To open, press down on actuator arm without touching the button.

Note. Opening the interlock switches in the modulator, power supply, coordinator or radar set control units or operating the ON-OFF switch on the power supply unit to the OFF position, deenergizes hold relay K503 in the modulator unit and disables the radar set. To enable the radar set after closing the switch, wait approximately 5 minutes for the time delay circuit to operate and then press the RADIATE switch to the ON position (RADIATE indicator lights when switch is pressed and remains so when switch is released).

19. Preferred Tube Types

The nonpreferred tube types listed below cannot be replaced with types other than listed. All other tubes in Radar Set AN/TPS–25 are preferred types, except type 5687 (V4, V516, V702, V706, V710, V714, V718), for which the preferred type (5687WA) may be substituted. Nonpreferred tube types cannot be substituted for preferred tube types in any instance.

Tube symbol No.	Tube type
V2	TU1271.
V3	6975.
V101, V102	5842.
V1809, V1810	6627/OB2WA.

20. Checking Cable Continuity

All cables used in Radar Set AN/TPS–25, except cable W2814 (engine generator), are terminated at each end by similar male and/or female plugs. To check continuity of these cables, follow the procedures outlined in *a* below. To check continuity of cable W2814, follow the procedure outlined in *b* below.

a. To check continuity of cables, proceed as follows:

(1) Disconnect plug terminations at each end (fig. 60 or 62, TM 11–5840–217–10) of cable to be checked, except cables W2601 and W2602 (one end permanently attached to shelter distribution box).

(2) Set the multimeter on the lowest resistance scale.

(3) Check the continuity between like contacts at each end of the cable (i.e., A to A, B to B, $\bar{a}$ to $\bar{a}$, etc.). All contacts (cable leads) should show continuity (approximately zero resistance), except for the contacts of the cables below.

Cable	Contacts
W2601	F, K, P, Q.
W2602	D.
W2603	B, C, F.
W2804	F, K, P, Q.
W2805	F, K, P, Q.
W2809	S, U, Z, b.
W2813	D.

b. To check continuity of cable W2814, proceed as follows:

(1) Disconnect cable leads from engine generator output terminations T1 and T3.

(2) Disconnect the connector plug from cable W2813.

(3) Set the multimeter on the lowest resistance scale.

(4) One rubber-covered lead will show continuity to plug terminals A and B, the other rubber-covered lead will show continuity to plug terminals C and E. No continuity should be measured between A and B terminals and C and E terminals.

Section III. REPAIRS AND ADJUSTMENTS

21. Replacement of Mixer Crystals

(fig. 24)

Check and replace mixer crystals CR1, CR2, and CR3 as follows:

a. Removal.

(1) Place the ON-OFF switch on the power supply unit to the OFF position.

(2) Open the front panel of the receiver-transmitter unit by loosening the 15 wing bolts and swinging out the hinged front panel.

(3) Remove the unattached end of the front panel support; swing it out, and place it in the hole in the support bracket (fig. 22).

(4) Remove the two screws that hold the interlock switch assembly and place the assembly as shown in figure 24.

(5) Loosen the bayonet-type plug connector (P404, P405, or P406) and remove it from the adapter (CP4, CP5, or CP6).

(6) Loosen the adapter with a wrench; unscrew and remove the adapter and crystal from the jack (J4, J5, or J6) in the mixer assembly.

(7) Remove the crystal from the adapter by pulling it straight out.

Note. The anode (−) contact of crystals CR1 and CR3 and the cathode (+) contact of CR2 are equipped with flange sleeves and inserted into the adapter.

b. Checking for Defective Crystal. Connect the multimeter to read resistance and check the forward-to-back resistance ratio of the crystal. The ratio should be at least 1 to 5 with a forward resistance of approximately 200 ohms.

Caution: **Do not check on a low resistance scale (not less than RX100) or leave multimeter across crystal for more than 10 seconds.**

c. Replacement.

(1) Select the proper replacement crystal as follows:

(*a*) CR1; type XL1058, with flanged sleeve at anode (−) end (opposite to end with black band).

(*b*) CR2; type XL1058, with flanged sleeve at cathode (+) end (cathode end marked with black band).

(*c*) CR3; type 1N23C.

Note. CR1 and CR2 are interchangeable except that flanged sleeve is mounted on anode contact for CR1 and on cathode contact for CR2. If a spare for one is available, but other is not, the flanged sleeve may be removed from one contact and placed on opposite end.

(2) Insert the crystal into the adapter, flanged end first.
(3) Insert the crystal and adapter into the jack and screw down fingertight. *Do not tighten with wrench.* (CR1 and CP4 to J4, CR2 and CP5 to J5, CR3 and CP6 to J6.)
(4) Connect the plug (bayonet connection) to the adapter (P404 to CP4, P405 to CP5, P406 to CP6).
(5) Replace interlock switch assembly in its original position (fig. 22); replace and tighten mounting screws.
(6) Remove the front panel support from the hole in the support bracket and replace the unattached end of the front panel support in the clip (fig. 22) on the inside of the front panel.
(7) Close the front panel and tighten the 15 wing bolts.
(8) Readjust the mixer crystal currents as outlined in paragraph 22.

22. Adjustment of Mixer Crystal Current (fig. 14)

If adjustment of the afc mixer crystal current (AFC MXR XTAL) is required, follow all steps of this procedure. If adjustment of the signal mixer crystal currents (MXR XTAL 1 and MXR XTAL 2) is required, omit the steps in *a* below and follow the steps in *b* below. In all steps, the radar set must be transmitting (RADIATE indicator lit).

a. Adjustment of Afc Mixer Crystal Current. Proceed as follows:

(1) Turn the meter switch to the AFC MXR XTAL position.
(2) Remove the attenuator adjustment tool from the front panel cover of the receiver-transmitter (B, fig. 3).
(3) Remove the cover of the ATTEN 1 ADJ access tube; insert the adjustment tool through the access tube, and engage the blade in the slot of the attenuator adjustment screw.
(4) Turn the attenuator adjustment screw until the meter reads 0.375 (0.75 ma).
(5) Remove the adjustment tool and replace the cover on the ATTEN 1 ADJ access tube.

b. Adjustment of Signal Mixer Crystal Currents. Proceed as follows:

(1) Turn the meter switch to the MXR XTAL 1 position.
(2) Remove the attenuator adjustment tool from the front panel cover of the receiver-transmitter (B, fig. 3).
(3) Remove the cover of the ATTEN 2 ADJ access tube, insert the adjustment tool through the access tube, and engage the blade in the slot of the attenuator adjustment screw.
(4) Turn the attenuator adjustment screw until the meter reads 0.375 (0.75 ma).
(5) Turn the meter switch to the MXR XTAL 2 position.
(6) Turn the attenuator adjustment screw until the meter reads 0.375 (0.75 ma).
(7) Alternate between meter switch positions MXR XTAL 1 and MXR XTAL 2; adjust the attenuator each time until both meter readings are approximately the same and between the limits of 0.337 (0.675 ma) and 0.412 (0.825 ma).
(8) Remove the adjustment tool and replace the cover on the ATTEN 2 ADJ access tube.
(9) Replace the attenuator adjustment tool in the clips on the front panel cover of the receiver-transmitter.

23. Servo Amplifiers Adjustments (fig. 25)

Perform the adjustment of the gain controls on the servo amplifiers only as an emergency measure(i.e., immediate operation of the radar set is required) and if higher echelon maintenance is unavailable. Alinement by higher echelon maintenance is required as soon as possible. To perform the adjustments, proceed as follows:

a. Turn the ON-OFF switch on the power supply unit to the OFF position.

b. Remove the connecting cables from the front panel of the coordinator unit.

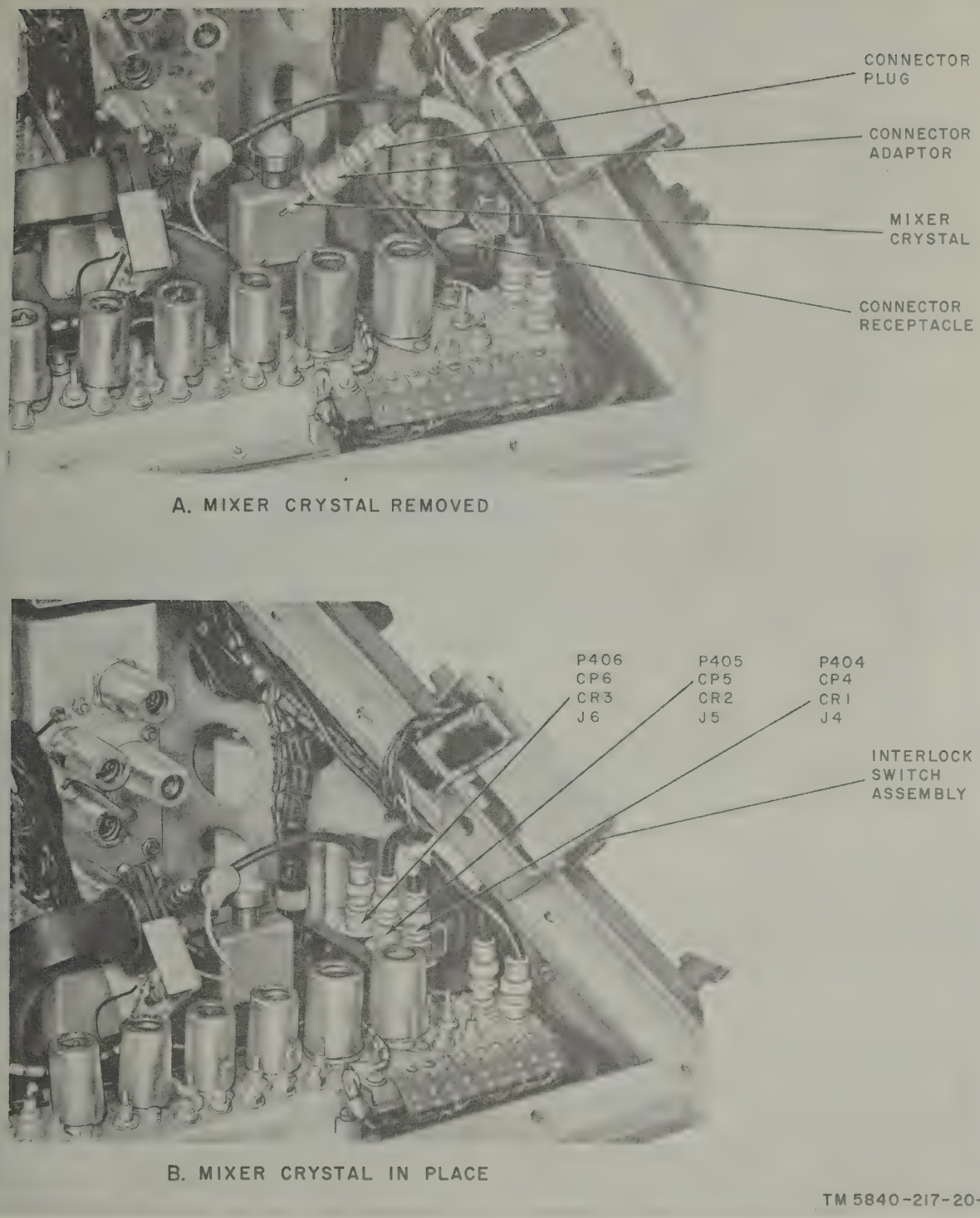


Figure 24. Replacement of mixer crystals.

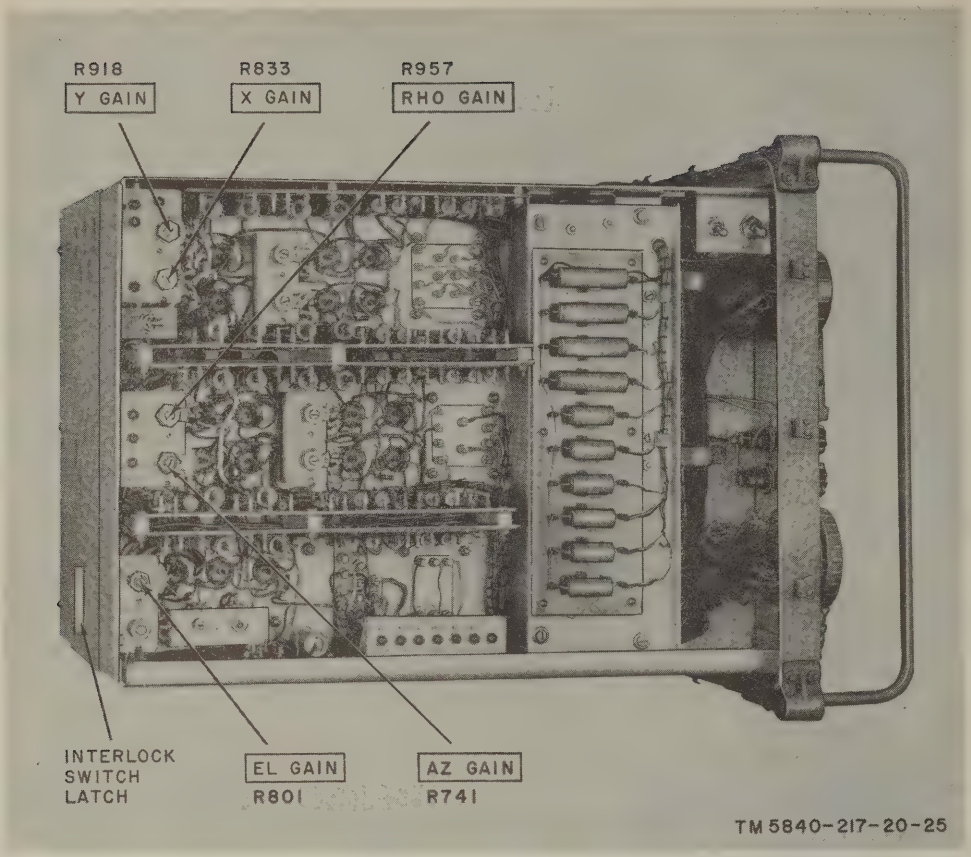


Figure 25. Coordinator, control locations.

c. Loosen the 12 front panel latches and pull the unit out of the case.

d. Reconnect the cables to the coordinator unit (fig. 60 or 62, TM 11–5840–217–10) and close the interlock switch (par. 18).

e. Operate the ON-OFF switch on the power supply unit to the ON position.

f. Loosen the locknut and adjust the gain controls listed in (1) through (5) below, for the circuit in which oscillations are present, until the oscillations *just* cease. Tighten the locknut.

(1) X GAIN (R833) for X digital counter.
(2) Y GAIN (R918) for Y digital counter.
(3) RHO GAIN (R937) for RANGE digital counter.
(4) AZ GAIN (R741) for antenna oscillations*.
(5) EL GAIN (R808) for antenna oscillations*

g. Turn the ON-OFF switch on the power supply unit to the OFF position.

*Antenna oscillation heard with ear pressed against antenna mast.

h. Remove the connecting cables from the front panel of the unit.

i. Release the interlock switch by returning the latch to the original position; screw down the free end of the latch with the knurled head screw.

j. Return the coordinator unit to the case, close the front panel latches, and reconnect the cables to the front panel (fig. 60 or 62, TM 11–5840–217–10).

24. Adjustment of Range Counters
(fig. 26)

Set the ELEVATION digital counter at 0 mils, MAP SCALE switch in 1:25K position, and RANGE digital counter to 18,000 meters. Operate the MAP SCALE switch to the 1:50K position; if the RANGE counter does not read 18,000 ±75 meters, readjuts the SCALE ADJ (R1490) as follows:

a. Turn the ON-OFF switch on the power supply unit to the OFF position.

b. Open the latches that hold the back cover of the radar set control unit, and remove cover.

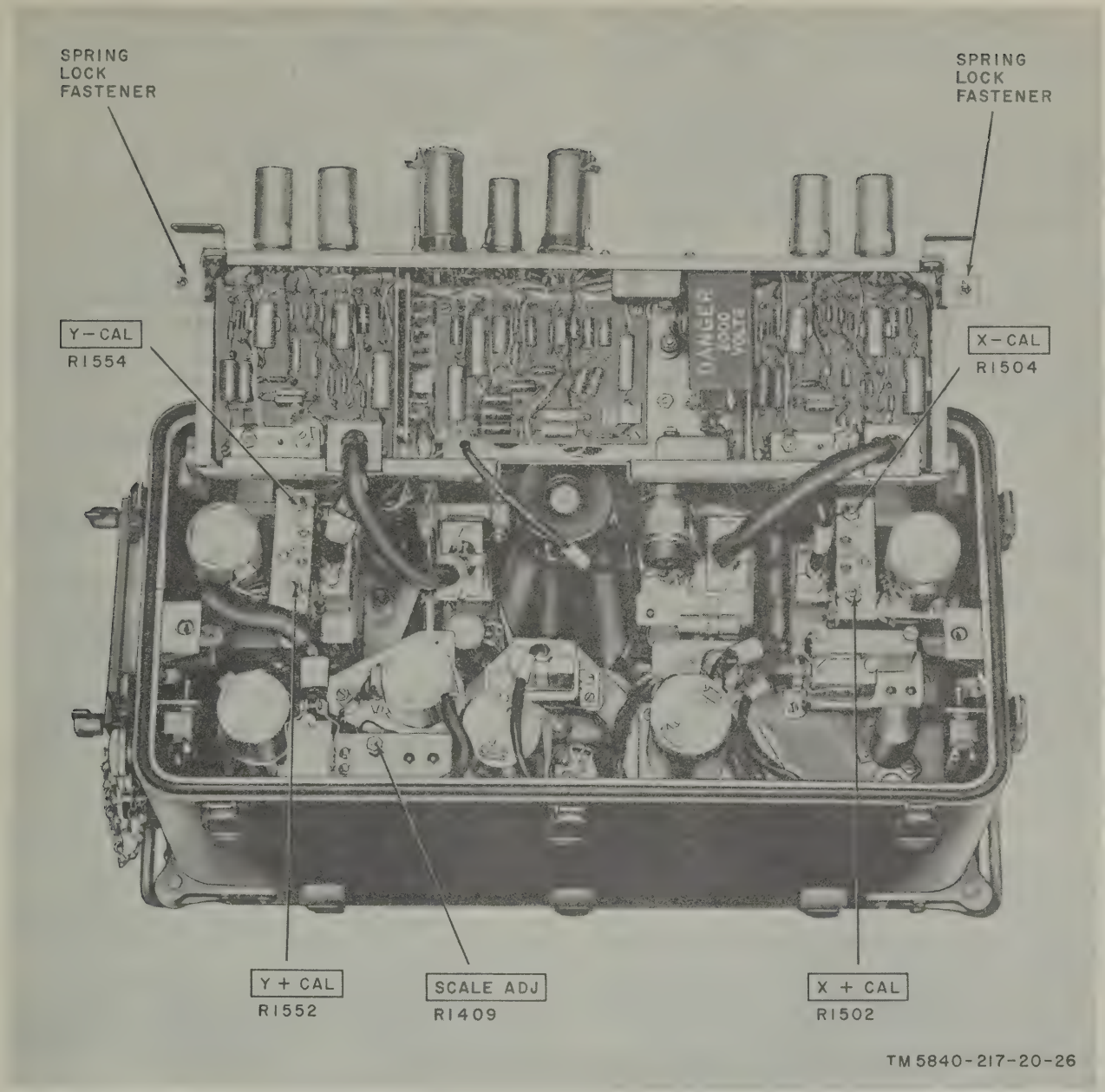


Figure 26. Radar set control, control locations.

c. Close the interlock switch latch (fig. 7, par. 18).

d. Open the two spring lock fasteners that hold the resolver drivers and video amplifier chassis (fig. 7), by turning the fastener ½ turn ccw with a screwdriver.

e. Operate the ON-OFF switch on the power supply unit to the ON position.

f. Set the ELEVATION counter to 0 mils, MAP SCALE switch to the 1:25K position and RANGE counter to 14,000 meters.

g. Operate the MAP SCALE switch to the 1:50K position.

h. Loosen the locknut on the SCALE ADJ (R1409) and adjust the control until the RANGE counter reads 14,000 meters.

i. Tighten the locknut on R1409.

j. Check the X and Y digital counter accuracy (par. 13*c*, step 21). If it is within tolerance, proceed to the next step. If it is not within tolerance, proceed to paragraph 25*e*.

k. Operate the ON-OFF switch on the power supply to the OFF position.

l. Close the resolver drivers, video amplifier chassis, and the two spring lock fasteners.

m. Enable the interlock switch by returning the latch to the original position; secure it to chassis with the knurled head screw.

n. Replace the back cover on the radar set control unit and close the latches.

25. Adjustments for X and Y Counters (fig. 26)

Check to see that the zero readings on the X and Y digital counters are properly oriented with the AZIMUTH and ELEVATION digital counters (par. 64*d*(6), TM 11–5840–217–10); reset them if they are incorrect. Set the MAP SCALE switch to the 1:25K position, ELEVATION counter to zero mils, AZIMUTH counter to 800 mils, and RANGE counter to 18,000 meters. Check to see that both X and Y counters read PLUS 12,728 ±140 meters; if not, readjust as follows:

a. Turn the ON-OFF switch on the power supply unit to the OFF position.

b. Open the latches that hold the back cover of the radar set control unit, and remove cover.

c. Close the interlock switch latch (fig. 7, par. 18).

d. Open the two spring lock fasteners that hold the resolver drivers and video amplifier chassis (fig. 7), by turning the fasteners ½ turn with a screwdriver.

e. Disengage the plotting board clutches (par. 67*a*, TM 11–5840–217–10), if used.

f. Operate the ON-OFF switch on the power supply to the ON position.

g. Set the ELEVATION counter to zero mils, MAP SCALE switch to 1:25K position, and RANGE counter to 14,000 meters.

h. Set the AZIMUTH counter for zero mil reading. Loosen the locknut and adjust Y+CAL (R1552) control for PLUS 14,000 meters on the Y counter; tighten locknut.

i. Set the AZIMUTH counter for 1,600 mils. Loosen the locknut and adjust X+CAL (R1502) control for PLUS 14,000 meters on the X counter; tighten the locknut.

j. Set the AZIMUTH counter for 3,200 mils. Loosen the locknut and adjust Y–CAL (R1554) control for MINUS 14,000 meters on the Y counter; tighten the locknut.

k. Set the AZIMUTH counter for 4,800 mils. Loosen the locknut and adjust the X–CAL (R1504) control for MINUS 14,000 meters on the X counter; tighten the locknut.

l. Engage the plotting board clutches, and orient with sector of interest (par. 67, TM 11–5840–217–10).

m. Operate the ON-OFF switch on the power supply to the OFF position.

n. Close the resolver drivers, video amplifier chassis, and the two spring lock fasteners.

o. Release the interlock switch by returning the latch to the original position; screw down the free end of the latch to the chassis with the knurled head screw.

p. Replace the back cover on the radar set control unit and close the latches.

26. Replacement of Lights and Indicator Lamps

To replace a shelter overhead light, follow the procedure outlined in *a* below. To replace the plotting table indicator lamp, follow the procedure outlined in *b* below. To replace a coordinator meter light, follow the procedure outlined in *c* below. Refer to paragraph 103, TM 11–5840–217–10 for replacement of edge lights and other indicating lamps.

a. Replacement of Shelter Lights (B, fig. 12).

(1) Loosen the captive screw that holds the light reflector and allow the hinged reflector to drop.

(2) Unscrew the defective lamp and replace it.

(3) Close the reflector and tighten the captive screw into threaded hole.

b. Replacement of Plotting Board Indicator Lamp (A, fig. 27).

(1) Remove the cover plate over the round access hole on the bottom of the plotting board (right side) by removing the eight screws that hold it in place.

(2) Turn the ON-OFF switch on the power supply unit to the ON position.

(3) Turn the AZIMUTH crank on the radar set control unit until the carriage arm is centered over the access hole.

(4) Turn the RANGE crank on radar set control unit until the carriage is centered over the access hole.

(5) Turn the ON-OFF switch on the power supply unit to the OFF position.

(6) Unscrew and remove the connector cap at the bottom of the indicator lamp.
(7) Use the tips of the fingernails under the lip of the lamp base and remove the lamp from the socket (pressure fit).
(8) Replace the lamp and connector cap.
(9) Operate the ON-OFF switch on the power supply unit to the ON position.
(10) Check the focusing of the indicator light (par. 27).
(11) Replace the cover plate on the access hole and secure it with the eight screws that were removed as instructed in step (1) above.

c. Replacement of Coordinator Meter Lights. The two lamps that provide illumination for the line voltage meter are mounted in bayonet sockets, which are located on the back of the coordinator unit front panel. To gain access to the lamps for replacement, follow the procedure outlined in paragraph 17*b*(1) through (5).

27. Focusing of Plotting Board Indicator Light (fig. 27)

To focus the plotting board indicator light, proceed as follows:

a. Perform steps in paragraph 26*b*(1) through (4).

b. Remove the Allen wrench (A, fig. 3) from the clip attached to the cover plate for the plotting board access hole.

c. Place a piece of masking tape on the plexiglass directly above the indicator light.

d. With the Allen wrench, slightly loosen the two setscrews (90° apart) nearest the lamp base.

e. While observing from the top of the plotting board, roughly focus the light (by moving lens up and down) for the smallest spot of light on masking tape.

f. Tighten the two setscrews nearest the lamp base and slightly loosen the other two setscrews (90° apart) that are farthest from lamp base.

g. Again, while observing from the top of the plotting board, slowly raise and lower the lens until the smallest spot of light on the masking tape is obtained; tighten the setscrews.

h. Rotate the carriage arm (through 180°), with the AZIMUTH crank on the radar set control unit; be sure that the indicator light does not touch the plexiglass.

i. Turn RANGE crank on radar set control unit through full range, 0 to 18,000 meters, observing that indicator light does not touch plexiglass.

j. If the light touches the plexiglass when following the instructions in *h* and *i* above, loosen the setscrews farthest from the lamp base and lower the light just enough to obtain clearance; tighten the setscrews.

k. Check the zeroing of the plotting board indicator light (par. 28).

l. Replace the Allen wrench in the clip on the cover plate.

m. Replace the cover plate on the access hole; secure it with the eight screws removed as instructed in paragraph 26*b*(1).

28. Zeroing of Plotting Board Indicator Light

To zero the plotting board indicator light, proceed as follows:

a. Turn the ON-OFF switch on the power supply unit to the ON position.

b. Center the plotting board indicator light on the plotting board by rotating the AZIMUTH crank.

c. Remove the 30° map sector holddown (fig. 57, TM 11–5840–217–10).

d. Operate the MAP ZERO switch to the zero position (toward plotting board).

e. Manually rotate the range coupling to the plotting board until the range counter reads zero.

f. Place a small piece of masking tape on the plexiglass over the light spot; mark the center of the light spot on the masking tape.

g. The light spot should not move more than $\frac{1}{32}$ inch from mark on masking tape while rotating the plotting board arm (with AZIMUTH crank) over the plotting board azimuth limits. Keep the RANGE counter at zero, by holding the range coupling on the plotting board.

h. If the light spot moves more than $\frac{1}{32}$ inch during the step in *g* above, loosen the two screws on the plotting board range coupling (fig. 61, TM 11–5840–217–10) with the proper Allen wrench (fig. 75, TM 11–5840–217–10), and slightly reposition the indicating light, without moving the range counter from zero.

i. Tighten the screws on the range coupling.

j. Repeat the steps in *g*, *h*, and *i* above and also the procedure for focusing the indicator light (par. 27), until light does not move more than $\frac{1}{32}$ inch during the full azimuth travel of the indicator arm.

k. Remove the masking tape and replace the 30° map sector holddown on the plotting board.

l. Return the MAP ZERO switch to the operate position (toward operator).

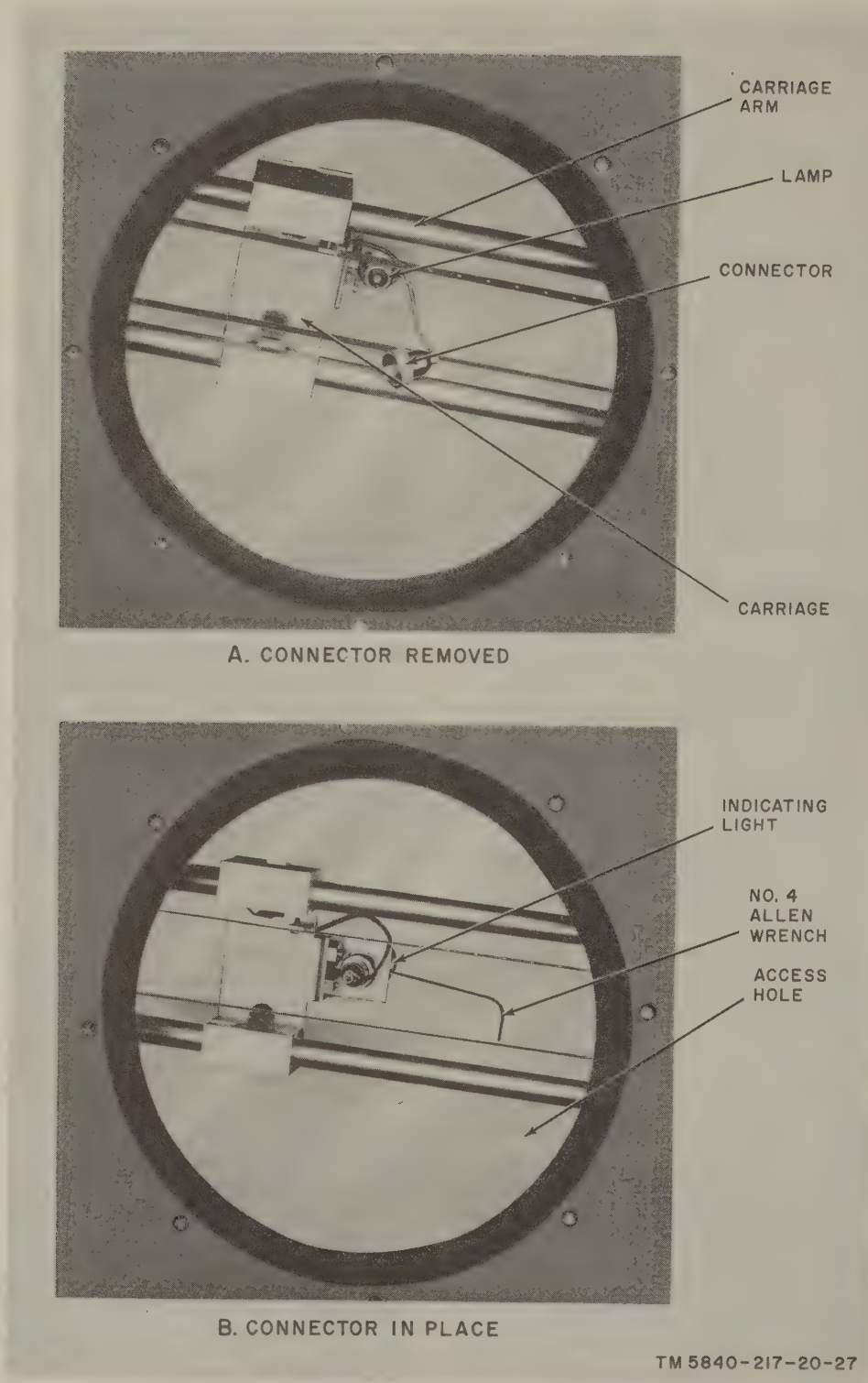


Figure 27. Replacement and adjustment of plotting board indicator light.

CHAPTER 3

BASIC THEORY

Section I. SYSTEM FUNCTION AND COMPONENT LOCATIONS

29. Grouping of Components

The general functioning of the radar set can be explained best by dividing the set into seven systems. The function of each system, the relationship between these systems, and the overall radar set are shown in the interconnected system block diagram (fig. 28) and explained in further detail in paragraphs 30 through 36. The components of the radar set are grouped into systems as follows:

a. Transmitting system.
b. RF system.
c. Receiving system.
d. Video and audio indicating systems.
e. Antenna positioning system.
f. Computing system.
g. Power system.

30. Transmitting System

(fig. 29)

The transmitting system consists of the trigger generator, modulator and modulator power supply mounted in the modulator (B, fig. 29), and the RF oscillator (magnetron) and pulse transformer which is mounted in the receiver-transmitter unit (A, fig. 29). The modulator power supply provides high voltage (3,800 volts dc) for the modulator. The trigger generator keys the modulator which, in turn, triggers the high voltage pulse (16,000 volts) that fires the magnetron approximately once every 540 microseconds. The magnetron generates the pulses of microwave energy that are radiated by the antenna. These RF pulses have a peak power of approximately 43 kilowatts and a duration of ½ microsecond. The pulse repetition rate of approximately 1,850 pulses per second is determined by the trigger generator in the modulator.

31. RF System

(fig. 30)

The RF system consists of the antenna reflector, wide and narrow beam antenna feed horns, a beam-switching motor, and a rotary joint assembly, all mounted in the antenna assembly (A, fig. 30). Waveguides (up to three sections) connect the antenna to the directional coupler, duplexer, and short slot hybrids, all mounted in the receiver-transmitter unit (B, fig. 30). RF pulses from the magnetron are fed through the isolator to the duplexer and prevented from entering the receiver signal system by the short slot hybrids and the transmit-receiver (tr) tube, then through the directional coupler, waveguides, rotary joint and either the wide or narrow beam antenna horn to the reflector. The return (echo) signal follows the same path except that the short slot hybrids, isolator, and tr tubes now present a high impedance path to the magnetron and a low impedance path to the receiver. A sample of the transmitted pulse is also taken out of the directional coupler and brought to the automatic frequency control crystal of the receiving system. The beam switching motor connects the wide beam (10° wide) antenna horn in positions 1, 2, and 3 of the AUTOMAN switch and the narrow beam (2° wide) in positions 4 and 5.

32. Receiving System

(fig. 31)

The receiving system consists of the frequency converter (mixer), afc, signal, and agc circuits. All components of the receiving system are located in the receiver-transmitter unit (A, fig. 31), except the RCVR GAIN control, located in the radar set control unit (C, fig. 31), and the balance of the agc circuits and the last three stages of the signal circuits are located in the coordinator unit (B, fig. 31). The echo signal (9375 mc) is received by the signal crystals and mixed with an RF signal (9435 mc) from the klystron local oscillator, producing the 60-mc signal intermediate frequency (IF). The IF signal is then amplified, also the modulation on the echo pulse is detected, amplified and then mixed with the range gate, and then these signals are fed to the video and audio

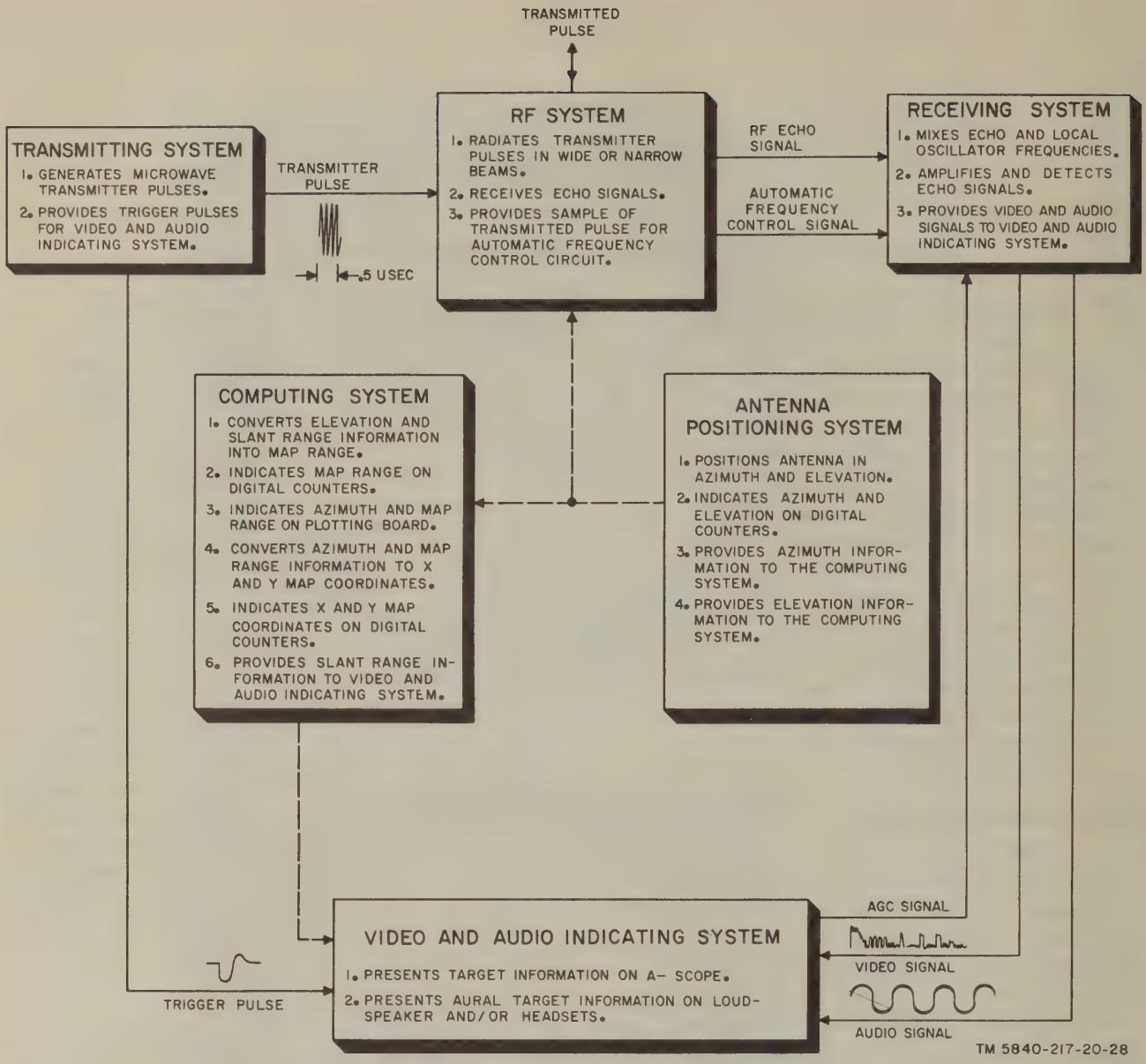

TRANSMITTED PULSE
RF SYSTEM
1. RADIATES TRANSMITTER PULSES IN WIDE OR NARROW BEAMS.
2. RECEIVES ECHO SIGNALS.
3. PROVIDES SAMPLE OF TRANSMITTED PULSE FOR AUTOMATIC FREQUENCY CONTROL CIRCUIT.
TRANSMITTING SYSTEM
1. GENERATES MICROWAVE TRANSMITTER PULSES.
2. PROVIDES TRIGGER PULSES FOR VIDEO AND AUDIO INDICATING SYSTEM.
TRANSMITTER PULSE
.5 USEC
RF ECHO SIGNAL
AUTOMATIC FREQUENCY CONTROL SIGNAL
RECEIVING SYSTEM
1. MIXES ECHO AND LOCAL OSCILLATOR FREQUENCIES.
2. AMPLIFIES AND DETECTS ECHO SIGNALS.
3. PROVIDES VIDEO AND AUDIO SIGNALS TO VIDEO AND AUDIO INDICATING SYSTEM.
COMPUTING SYSTEM
1. CONVERTS ELEVATION AND SLANT RANGE INFORMATION INTO MAP RANGE.
2. INDICATES MAP RANGE ON DIGITAL COUNTERS.
3. INDICATES AZIMUTH AND MAP RANGE ON PLOTTING BOARD.
4. CONVERTS AZIMUTH AND MAP RANGE INFORMATION TO X AND Y MAP COORDINATES.
5. INDICATES X AND Y MAP COORDINATES ON DIGITAL COUNTERS.
6. PROVIDES SLANT RANGE INFORMATION TO VIDEO AND AUDIO INDICATING SYSTEM.
ANTENNA POSITIONING SYSTEM
1. POSITIONS ANTENNA IN AZIMUTH AND ELEVATION.
2. INDICATES AZIMUTH AND ELEVATION ON DIGITAL COUNTERS.
3. PROVIDES AZIMUTH INFORMATION TO THE COMPUTING SYSTEM.
4. PROVIDES ELEVATION INFORMATION TO THE COMPUTING SYSTEM.
AGC SIGNAL
VIDEO AND AUDIO INDICATING SYSTEM
1. PRESENTS TARGET INFORMATION ON A- SCOPE.
2. PRESENTS AURAL TARGET INFORMATION ON LOUDSPEAKER AND/OR HEADSETS.
VIDEO SIGNAL
TRIGGER PULSE
AUDIO SIGNAL
TM 5840-217-20-28

Figure 28. Radar Set AN/TPS–25, system functional block diagram.

indicating system. The afc crystal in the frequency converter circuits receives a sample of the transmitted pulses and mixes with the output of the local oscillator to produce the 60-mc afc intermediate frequency. The afc IF is amplified, detected, and applied to the afc sweep generator. The afc output voltage is applied to the repeller of the local oscillator, varying its frequency in accordance with variations in the transmitted frequency. The automatic gain control signal is controlled by the amplitude of the video and audio signals and the setting of the receiver gain control (RCVR GAIN) and fed back to the IF amplifiers in the signal circuits.

33. Video and Audio Indicating System (fig. 32)

The video and audio indicating system consists of the A-scope timing circuits, scope sweep circuits, audio circuits (all located in the coordinator unit (A, fig 32)), and the scope deflection circuits (V613 located in the coordinator unit and the balance of the circuit along with the A-scope mounted in the radar set control unit (B, fig. 32)). The range and scope timing circuits receive trigger pulses from the transmitting system and provide the timing pulses for the scope sweep circuits and range gates which

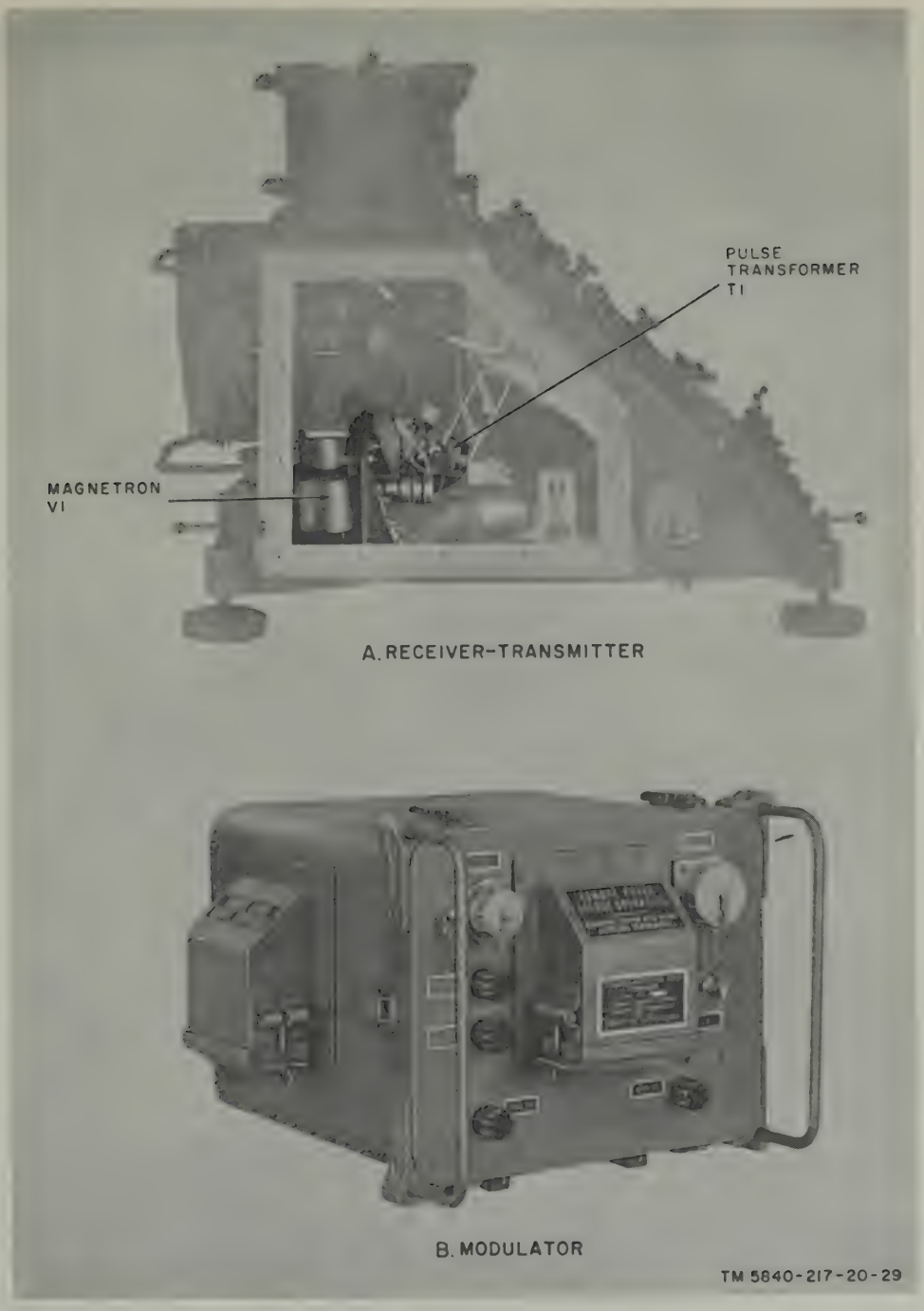


Figure 29. Transmitting system components.

are both delayed and the amount of this delay determined by the setting of the range potentiometer (R1402). The scope deflection circuits receive the video signals and the range gates from the receiving system. The signals are amplified and fed to the vertical deflection plates of the A-scope. The scope sweep circuits receive timing pulses from the scope timing circuits and generate unblanking and sweep voltages which are applied to the control grid and horizontal deflection plates of the A-scope. The audio circuits amplify the audio signals from the boxcar detector in the receiving system and feed them to a loudspeaker and/or headsets. In position 4 of the AUTOMAN switch, the audio signal is applied to the vertical plates of the A-scope in place of the video

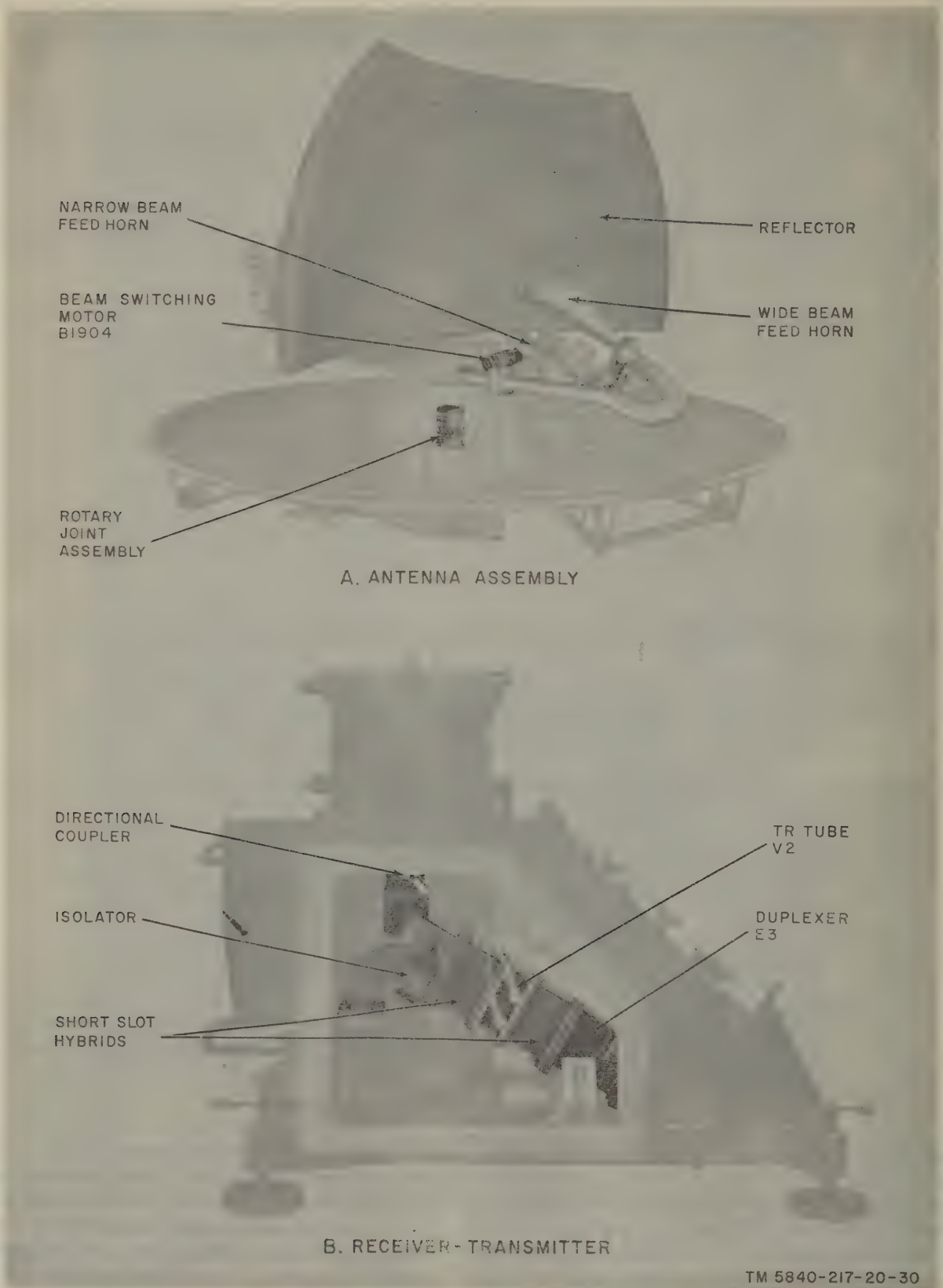


Figure 30. RF system components.

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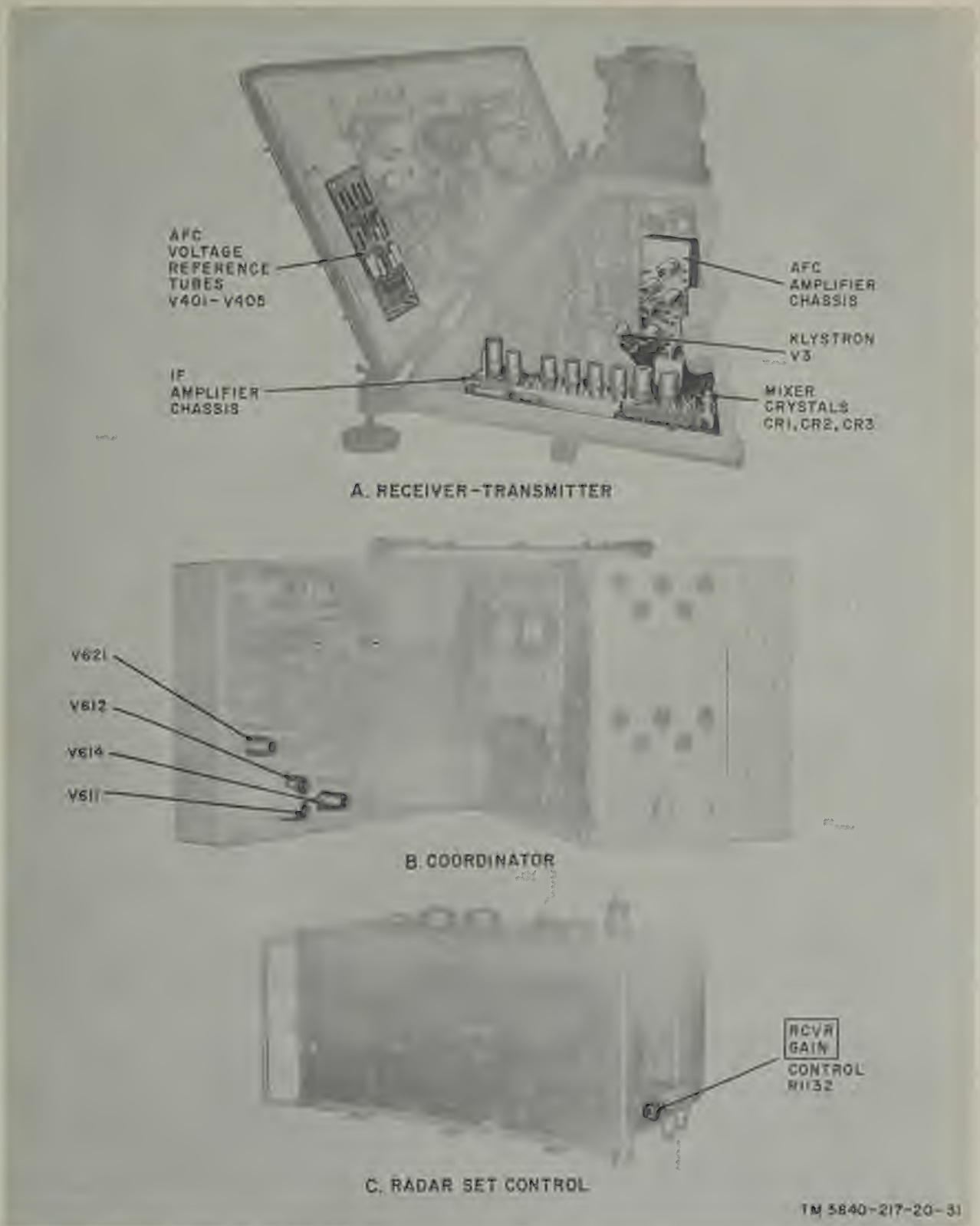

Figure 31. Receiving system components.

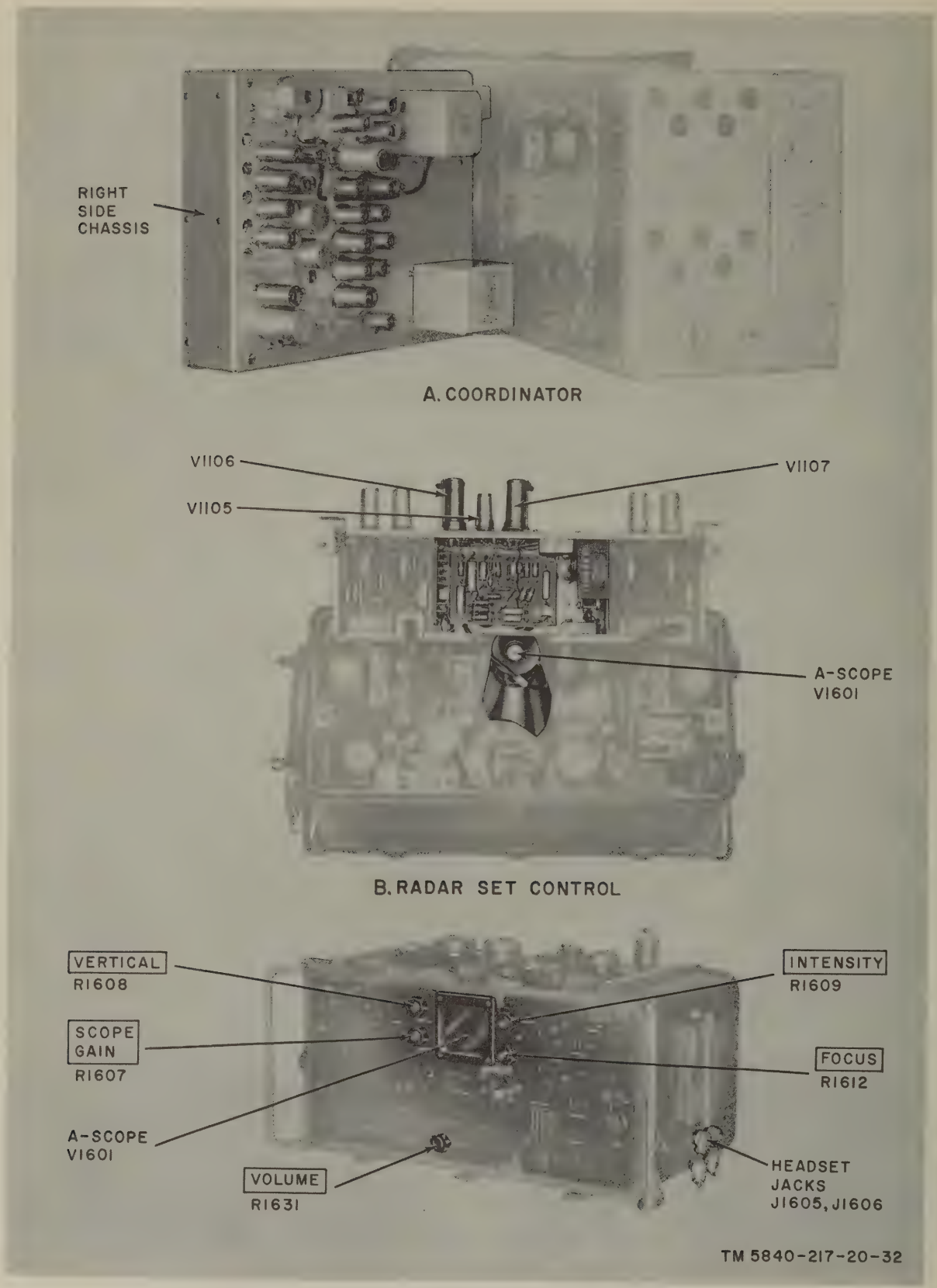

Figure 32. Video and audio indicating system components.

signal. A portion of the detected signals is fed back to the agc circuits in the receiving system.

34. Antenna Positioning System

(fig. 33)

The antenna positioning system provides manual elevation and azimuth control of the antenna. Automatic sector scanning in azimuth and positioning of the plotting board tactical display indicator are also provided. The elevation and azimuth synchro control transmitters and the elevation and azimuth servo motors are mounted in the antenna assembly (A, fig. 33). The elevation and azimuth servo amplifiers are located in the coordinator unit (B, fig. 33). The elevation and azimuth synchro control transformers, the sector scan drive motor, the elevation and azimuth counters, and cranks are located in the radar set control unit (C, fig. 33). An error voltage will be generated between the synchros and fed to the servo amplifiers when the elevation or azimuth cranks or azimuth sector scan drive motor (mechanically coupled to the azimuth synchro control transformer) is operated. This error voltage is amplified by the servo amplifier and applied to the servo motor. The servo motor will drive the antenna to the desired elevation or azimuth position, and when in this position, the synchro error voltage will be zero.

35. Computing System

(fig. 34)

The computing system provides visual indications of the target range on both the plotting table and digital counters. Target azimuth, elevation, and range are resolved into X and Y map coordinates for presentation on the digital counters. The computing system is comprised of the elevation resolver circuits (in the radar set control unit (B, fig. 34)), range circuits in the coordinator unit (A, fig. 34), and the balance of the circuits are in the radar set control unit, azimuth resolver circuits (in the radar set control unit), X and Y circuits (X and Y servo amplifiers are in the coordinator unit and the balance of the circuits are in the radar set control unit). The elevation resolver circuits receive elevation (antenna tilt) information from the antenna positioning system and slant range information from the range potentiometer. The resolved information (map range) is fed to the range circuit for presentation on the range digital counters, the plotting board, and the azimuth resolver circuits, and then to be resolved with the azimuth position information, received from the antenna positioning system. This resolved information (X and Y map coordinates) from the azimuth resolver circuits is fed to the X and Y circuits for presentation on the X and Y digital counters.

36. Power System

(fig. 35)

The power system provides all the ac and dc voltages required in the radar set. The ac power distribution circuits are mainly located in the shelter except for the engine generator (a separate unit, placed some distance from the shelter), the ON-OFF power switch for the radar set (on the power supply front panel), and the shelter lights, ventilators, and heater are related as indicated in 2, figure 37. The components of the operators site dc power circuits (B, fig. 35) are all located in the power supply unit except the scope power supply which is located in the coordinator unit. The components of the antenna site dc power circuits (A, fig. 35) are all mounted in the receiver-transmitter unit, except for the high voltage power supply which is located in the modulator unit, and rectifier CR1901, located in the antenna.

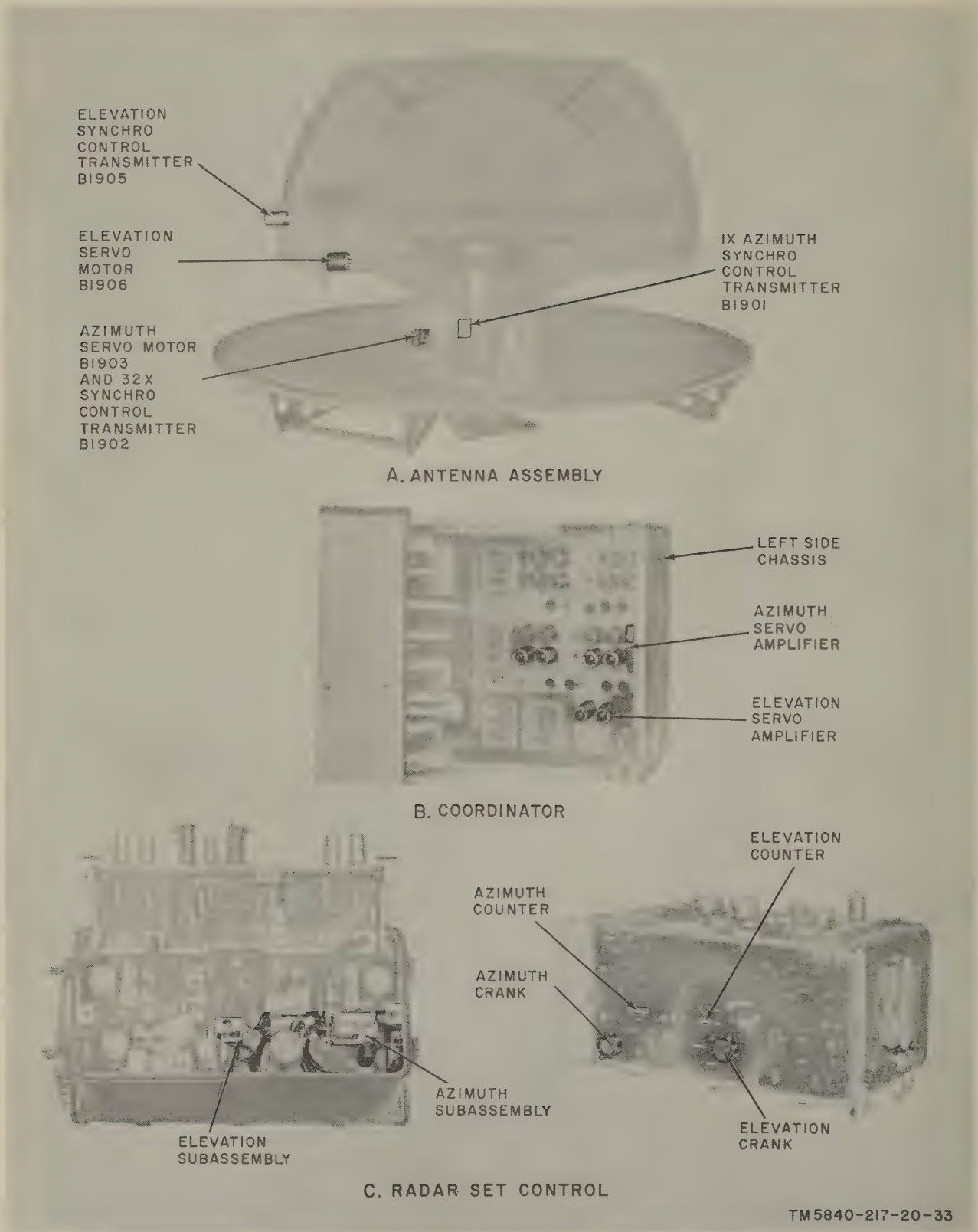

Figure 33. Antenna positioning system components.

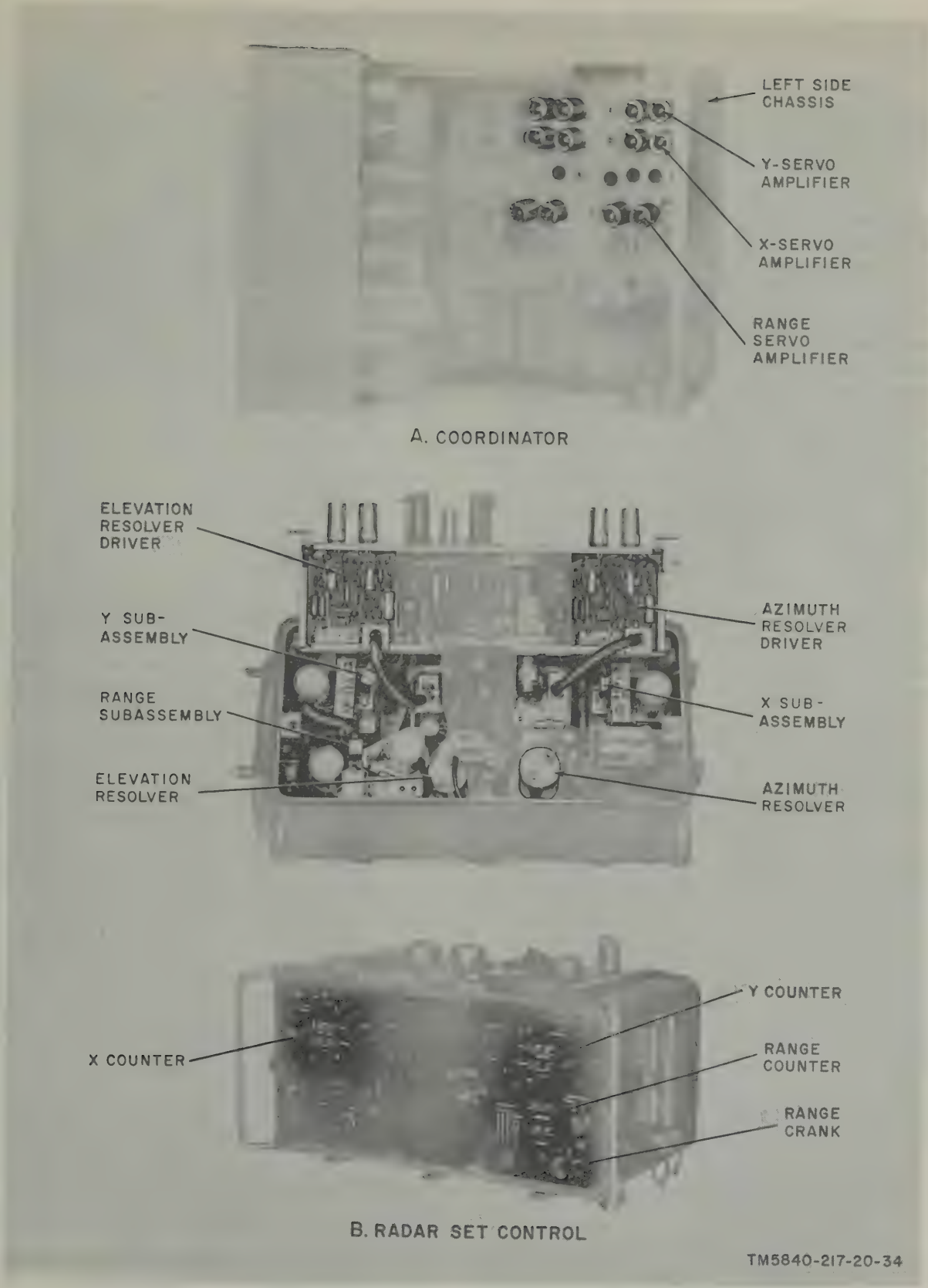

Figure 34. Computing system components.

Section II. COMPLETE BLOCK DIAGRAM

37. Purpose

The complete block diagram of Radar Set AN/TPS–25 (1 and 2, fig. 37) can be used as a quick review of the basic theory of the equipment by a radar repairman who has not worked with the equipment for some time. The diagram also enables the repairman who is familiar with radar principles, but who is not acquainted with this particular set, to gain a basic understanding of the units and stages in the equipment. When troubleshooting, the block diagram is valuable because it enables the repairman to narrow most common troubles down to a particular stage within the equipment. This type of troubleshooting is important because it eliminates a considerable amount of operating time loss that results when the equipment has to be shut down to await higher echelon maintenance.

38. Timing

(figs. 36 and 37)

a. When the power supply ON-OFF switch is operated to ON, power is applied to all the filament and power transformers of the radar set, except the plate transformer of the modulator power supply.

b. Five minutes after power is applied, time delay relay K504 is energized and the transmitting system can be enabled by pressing the RADIATE switch to the ON position.

c. When the transmitting system is enabled, trigger generator V504 (1, fig. 37) produces pretrigger pulses at the rate of approximately 1,850 pulses per second. Each of these pulses triggers the modulator, which discharges the pulse forming network and creates a pulse which is fed to pulse transformer T1 in the transmitter. Transformer T1 provides the high voltage pulse to the magnetron and the trigger pulse (A, fig. 36) for the video and audio indicating system. The important pulses and wave forms used in timing the set are shown in figure 36.

(1) The magnetron produces .5-microsecond bursts of RF energy (B, fig. 36). The RF energy is fed through the RF system to the antenna.

(2) The trigger pulse to the video and audio indicating system is fed to trigger multivibrator V601, which provides the gating pulse (C, fig. 36). The duration of the gating pulse depends on the dc voltage level provided by the setting of the range potentiometer (R1402) (F, fig. 36).

(3) The leading edge of the gating pulse permits range and scope rundown generators V617 and V604 to conduct, and generate the range and scope linear rundowns (D and E, fig. 36).

(4) Gate trigger pulse (G, fig. 36) is generated at the end of the range rundown and triggers the range gate generator which produces the range gate (H, fig. 36). The gate trigger pulse also terminates the gating pulse.

Note. In positions 1 and 2 (AUTO) of the AUTO-MAN switch, auto range sweep potentiometer R724 and RANGE potentiometer R1402B determine the duration of the gating pulse and the position of the range gate on the scope sweep.

(5) Scope trigger pulse (I, fig. 36) is generated at a level on the scope rundown (determined by RANGE potentiometer R1402B only) and triggers the unblanking pulse and the scope sweep (J and K, fig. 36); both 11 microseconds in duration.

(6) Echo signals pass through the receiving system and are converted to video and audio signals. In positions 1, 2, 3, and 5 of the AUTO-MAN switch, the video signals and the range gate go to the scope deflection circuits and then to the vertical deflection plates of the A-scope. The audio signals from the receiving system are fed to the audio circuits and loudspeaker and/or headsets in all positions of the AUTO-MAN switch. In MAN TRACK AUDIO position of the AUTO-MAN switch, the audio signal is presented on the A-scope.

d. Approximately 540 microseconds after the previous trigger, another trigger fires the magnetron and the trigger multivibrator, and the cycle is repeated. The rapid pulse repetition rate (approximately 1,850 pulses per second) produces a steady picture on the scope face. In positions 3 and 5 of the AUTO-MAN switch, the range gate (H, fig. 36) appears in the same relative position on the scope face. In positions 1 and 2 of the

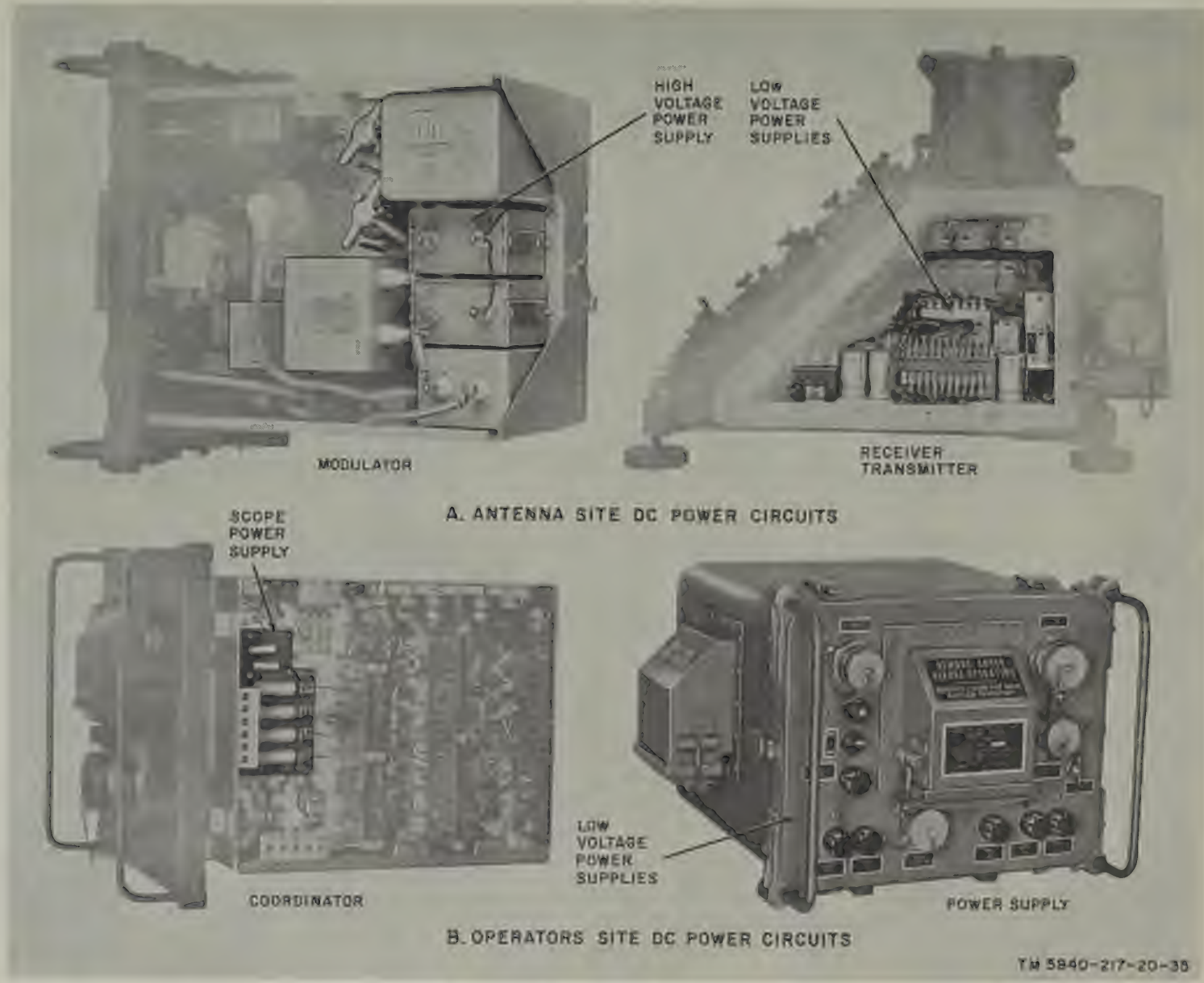

Figure 35 Power system components.

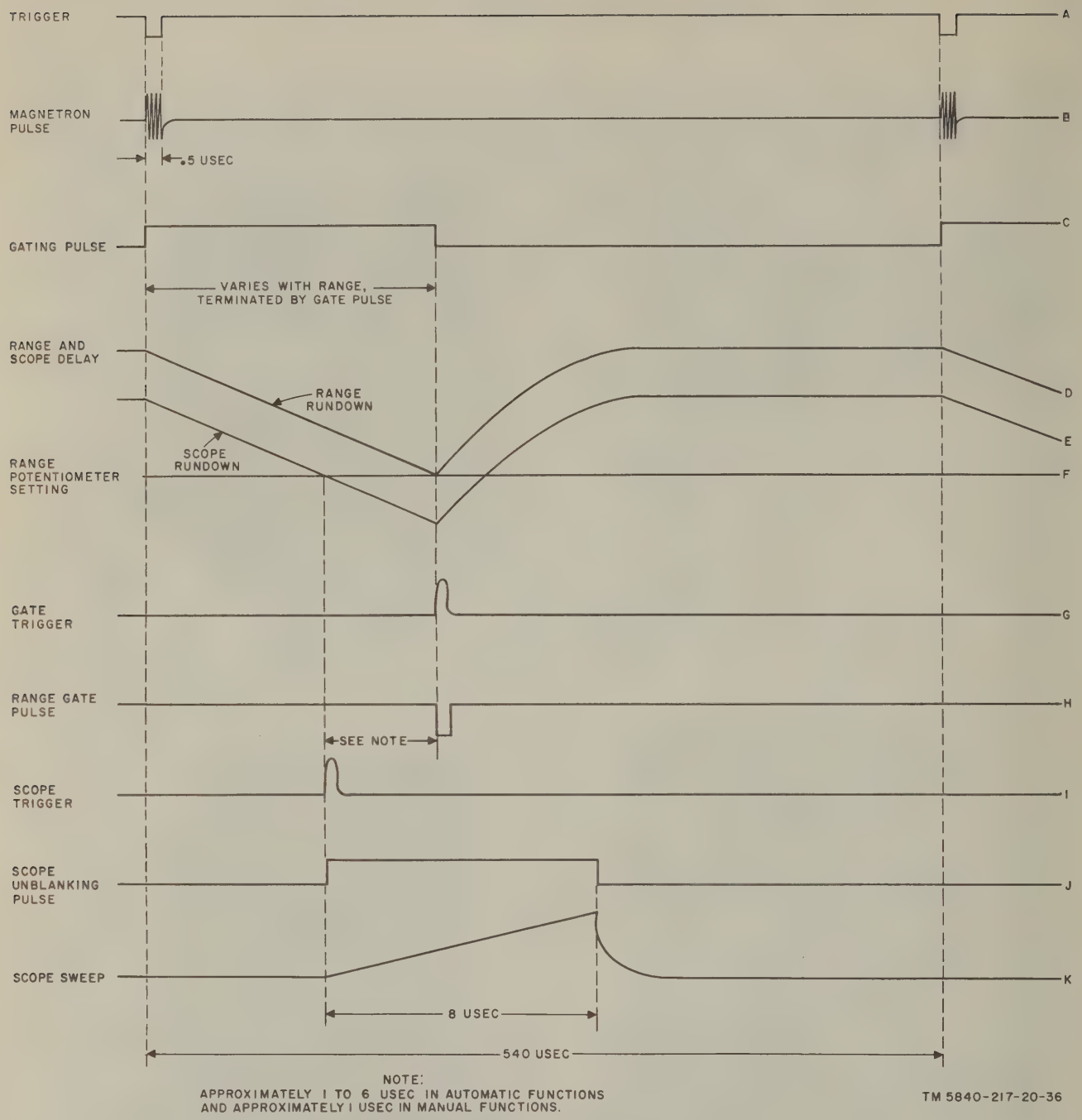

Figure 36. Radar Set AN/TPS-25, basic timing chart.

switch, the range gate travels from left to right across the scope face.

39. Complete Block Diagram Discussion (fig. 37)

Functionally, the radar set is divided into seven systems: transmitting, RF, receiving, video and audio indicating, antenna positioning, computing, and power. Each system in the block diagram is shown as a block inclosed by solid lines. All systems, except the transmitting and RF systems, have groupings of stages that act together as complete circuits. These circuits are shown as blocks inclosed in broken lines. Signal paths are shown on the diagram by solid lines with arrowheads, mechanical connections are indicated as dashed

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lines, and waveguides are shown as double lines with arrows indicating signal flow. The important waveforms for the systems, circuits, and stages are shown where applicable throughout the block diagram. The separate systems are discussed in paragraphs 40 through 46.

40. Transmitting System

Trigger generator V504 produces the pretrigger pulses that control the timing of the entire radar set. The timing may be adjusted by potentiometer R517 (mounted on the modulator unit chassis) in the grid circuit of the tube. These pretrigger pulses control the firing of thyratron-type modulator V503. When the modulator fires, it discharges pulse forming network Z501 and creates a pulse which is fed to the primary of pulse transformer T1. The stepped-up pulse from T1 is applied to the cathode of RF oscillator (magnetron) V1. The resultant transmission pulse is fed to the RF system through a waveguide. Another secondary winding of pulse transformer T1 supplies a negative timing pulse to trigger multivibrator V601 in the video and audio indicating system. The magnetron plate current (14 milliamperes, nominal) may be measured and adjusted on the front panel of the receiver-transmitter unit by placing the meter switch in MAG CUR (20 MA FS) position, and adjusting the MAG CUR ADJ control.

41. RF System

The transmitted pulse from the transmitting system is fed through the isolator to duplexer E3. The combination of the short slot hybrids and tr tube V2 presents a high impedance path for the transmitted pulse to the receiving system and a low impedance path to the antenna. The transmitted pulse is fed through waveguides to the directional coupler, rotary joint assembly, and either the wide or narrow beam feedhorn (switched by beam switching motor B1206) to the antenna reflector. The echo signals (from moving and/or fixed targets) are received by the antenna and follow the same path as the transmitted pulse to the duplexer. The short slot hybrids and tr tube now present a low impedance path to the receiver. The echo signals are then fed to signal mixer crystals CR1 and CR2 of the receiving system. A sample of the transmitted pulse is obtained from the directional coupler and fed to afc mixer crystal CR3 in the receiving system. ATTENUATION test point TP401 at the directional coupler measures the transmitted power.

42. Receiving System

a. Frequency Converter Circuits. Echo signals at the transmitted frequency and the frequency generated by local oscillator V3 (klystron), 60 megacycles above the transmitted frequency, are mixed in signal mixer crystals CR1 and CR2 to produce the intermediate frequency of 60 mc for the signal circuits. The frequency of the klystron may be varied by inserting an adjusting tool in the LO ADJ access tube, on the receiver-transmitted front panel. A sample of the RF energy from the directional coupler is fed through attenuators to automatic frequency control crystal CR3. The transmitted frequency is combined with the local oscillator frequency in this crystal to produce an IF of 60 mc for the afc circuits. Meter M401 provides means of reading the crystal current of all three mixer crystals. ATTEN 1 ADJ and ATTEN 2 ADJ access tubes are provided on the front panel of the receiver-transmitter unit to gain access to the mixer attenuators to adjust the current through the mixer crystals.

b. Signal Circuits. The balanced if signal from CR1 and CR2 is amplified by cathode input amplifiers V101 and V102 and IF amplifiers V103 through V106. The amplified signal is then detected by crystal detector CR101. The resultant video signal is amplified by V107 and coupled by cathode follower V108 to video amplifier V611. The signal is further amplified by V611 and coupled to boxcar detector V621 by cathode follower V612A. The range gate from the range timing circuits is combined with the video signals before the boxcar detector for presentation on the A-scope through the scope deflection circuits in the video and audio indicating system. The range gate also *gates* a portion of the video signal to the boxcar detector. If a moving target comprises part of the video signal, an audio signal results. The audio signal and/or video levels are then fed to the audio circuits in the video and audio indicating system.

c. Afc Circuits. The automatic frequency control circuits are placed into operation when the AFC (spring return) switch on the front panel of the receiver-transmitter unit is in the ON (normal) position. The IF from afc mixer crystal CR3 is amplified by afc IF amplifiers V201 and V202 and is coupled to afc ratio detector

V203. The detector produces positive, negative, or no output pulses, depending on whether the frequency is below, above, or at 58 mc. These pulses are amplified by V204 and fed to afc sweep control diode V205A and afc sweep generator V206. The dc output produced is applied to the repeller plate of the klystron local oscillator, causing the klystron to change frequency in accordance with the transmitted frequency and maintaining the signal IF at 60 mc. Afc clamp V205B prevents the klystron repeller from going more positive than the cathode. The afc operating point may be adjusted by the AFC ADJ control on the receiver-transmitter front panel.

d. Agc Circuits. The automatic gain control circuits receive a dc level (determined by the signal amplitude) from the audio and agc amplifier V622A in the audio circuit of the video and audio indicating system. The RCVR GAIN control (R1132), mounted on the side of the radar set control unit, clamps the agc feed-back voltage, at a minimum level, determined by the control setting, through agc clamp V614B, thus maintaining maximum sensitivity without excessive noise under no signal conditions. Agc cathode follower V612B couples the agc voltage to the grids of IF amplifiers V103 and V104 in the signal circuits.

43. Video and Audio Indicating System

a. Range Timing Circuits. Trigger multivibrator V601 receives the trigger pulse from the transmitting system and generates a positive gating pulse, with a duration determined by the RANGE potentiometer setting. This pulse is coupled by cathode follower V602B to range gating diode V615B and scope gating diode (in the scope timing circuits) V603A. The leading edge of the pulse gates the range rundown generator (V617) unless delayed by the range start clamp (V618B). In positions 3, 4, and 5 of the AUTO-MAN switch, the cathode bias of V618B is fixed. In positions 1 and 2 of the switch, auto range drive motor B601 positions auto range sweep potentiometer R724, which provides a varying voltage to V618B, through auto range sweep relay K601. Range gate pickoff diode V618A, biased by the setting of range potentiometer R1402B, determines the duration of the range rundown. The range pulse is generated by range trigger generator V619, and fed to range gate generator V620. The range gate generated is fed to the boxcar detector (V621) in the receiving system and also to shutoff diode V614A. The diode conducting restores trigger multivibrator V601 to its original state and terminates the gating pulse. Screen voltage regulator V602A controls the screen voltage on the range and scope rundown generators. Range compensating diodes V615A and V616 are provided to maintain range accuracy by compensating for filament voltage variations.

b. Scope Timing Circuits. Scope gating diode V603A receives the range gating pulse from V602B. The leading edge of the pulse, delayed by scope start clamp V605A, triggers the scope rundown generator (V604). Scope pickoff diode V605B, biased by range potentiometer R1402B, determines the timing of the scope trigger pulse, by allowing scope trigger generator V606 to conduct. The trigger pulse is then amplified by scope trigger amplifier V607B and fed to the scope sweep circuits.

c. Scope Deflection Circuits. Scope cathode follower V613 couples the video signals and range gate from the receiving system to the first video amplifier (V1105). The signals are further amplified by video amplifiers V1106 and V1107 and fed to the vertical deflection plates of A-scope V1601. In position 4 of the AUTO-MAN switch, the audio circuits supply audio to the first video amplifier for the audio to be displayed on the A-scope.

d. Scope Sweep Circuits. The sweep trigger pulse from the scope timing circuits triggers unblanking multivibrator V608 which is a one-shot multivibrator with an output positive pulse duration of approximately 11 microseconds. The unblanking pulse is coupled by cathode follower V609 to the control grid of A-scope V1601. The sweep trigger pulse also starts the scope sweep by triggering sweep generator V607A. Sweep disconnect V603B terminates the scope sweep. Sweep cathode follower V609A couples the sweep voltage in one horizontal deflection plate of the A-scope and to phase inverter V610. The phase-inverted output of V610 is then applied to the other horizontal deflection plate of the A-scope.

e. Audio Circuits. Cathode follower V622B couples the audio signal and video level, detected by boxcar detector V621 in the receiving system, to audio and agc amplifier V622A. The video level and a portion of the audio signal are fed to the agc circuits of the receiving system. The balance of the audio signal is amplified by volume control V623. VOLUME control R1633 (on the

front panel of the radar set control unit), in the screen circuit of V623, controls the gain of this stage. Audio amplifier and phase inverter V624 further amplify, invert, and feed the audio signal to push-pull audio power amplifiers V625 and V626. The audio output is then fed to the loudspeaker and/or headsets and, in position 4 (MAN TRACK AUDIO) of the AUTO-MAN switch, to the scope deflection circuits.

44. Antenna Positioning System

a. Elevation Circuits. When the ELEVATION crank (on the front panel of the radar set control unit) is rotated, elevation digital counter (M1201) indicates the antenna tilt in mils, PLUS or MINUS, from a level condition. This is accomplished by a mechanical linkage that couples the counters to the crank. Elevation synchro control transformer B1201 and the elevation resolver in the computing system are also mechanically coupled to the crank. Displacement of the rotor of B1201 with respect to the rotor of synchro control transmitter B1905 causes an error voltage to exist on the rotor of B1201. This error voltage is amplified and inverted by voltage amplifier and phase inverter V801. The signal is fed to phase sensitive detector V802. The dc output level of the phase sensitive detector changes the dc operating level of magnetic amplifier driver V803. This changes the direct current through magnetic amplifier T802. The unbalance in the magnetic amplifier will drive elevation servo motor B1906 in a direction, such that the rotor of B1905 is turned toward the new position of B1201. When the rotor of B1905 is in the same position as the rotor of B1201, the error voltage will be zero and the magnetic amplifier will again be balanced. The antenna is mechanically coupled to B1905 and B1906 and will be at the desired tilt position selected on the ELEVATION counter.

b. Azimuth Circuits. The AZIMUTH crank and sector scan drive motor B1303 control the position of the antenna in azimuth. In position 1 of the AUTO-MAN switch, B1303 is energized and brake L1301 locks the AZIMUTH crank. In positions 2, 3, 4, and 5 of the switch, L1301 is deenergized (unlocking the crank) and B1303 is locked. When the crank is rotated, or the sector scan drive motor is energized, mechanical coupling will drive the azimuth digital counter (M1301), the plotting board indicator, the azimuth resolver in the computing system, and the rotors of the 1X and 32X azimuth synchro control transformers (B1301 and B1302). Displacement of the rotors of B1301 and B1302 with respect to the rotors of 1X and 32X azimuth synchro control transmitters B1901 and B1902 causes error voltages to exist on the rotors of B1301 and B1302. Relay K801, in the plate circuit of the 1X azimuth amplifier-rectifier (V808), is deenergized when the 1X error voltage is large. Because of this, the 1X synchros take control and eliminate any possible ambiguity in the 32X synchro system. The AZIMUTH WARNING light (on the radar set control unit front panel) will give a steady indication when the 1X synchros are in control. As the antenna nears the selected azimuth, the error voltage decreases and relay K801 is again energized, permitting the 32X synchro to take control. The error voltage is amplified and inverted by voltage amplifier and phase inverter V809 and fed to phase sensitive detector V810. The dc output level of the phase sensitive detector changes the dc operating level of magnetic amplifier driver V811. This changes the direct current through magnetic amplifier T805. The unbalance in the magnetic amplifier will drive azimuth servo motor B1903 in a direction that the rotors of B1901 and B1902 are turned toward the new rotor positions of B1301 and B1302. When the rotors of B1901 and B1902 are in the same positions as the rotors of B1301 and B1302, the error voltage will be zero and the magnetic amplifier will again be balanced. The antenna is mechanically coupled to B1901; therefore, B1902 and B1903 will be at the azimuth position selected by the AZIMUTH crank or sector scan motor. When the antenna is rotated to a limit position, the AZIMUTH WARNING light will present a flashing indication when the antenna is just at the limit, and will light continuously when the antenna is past the limit.

45. Computing System

a. Elevation Resolver Circuits. The elevation resolver circuits convert slant range and antenna elevation (tilt) position information into map range. The actual conversion is performed by elevation resolver B1202. Slant range potentiometer R1402A, rotated by the RANGE crank, provides one voltage input to difference amplifier V1101A. The other input to V1101A is provided by B1202 compensator windings (voltage from compensator windings varying with stator winding voltage). The difference voltage is amplified

by V1101 and coupled to elevation resolver driver V1102, which feeds the stator of B1202. The stator voltage induces a voltage on the rotor, the amplitude of which varies sinusoidally with rotor position. The rotor of B1202 is mechanically coupled to the ELEVATION crank; therefore, rotating the hand wheel displaces the rotor. The output voltage (from B1202 rotor) supplies the map range information to the range circuits and azimuth resolver circuits.

b. Range Circuits. The map range voltage from the elevation resolver circuits and the actual range servo position (given by the voltage from RHO potentiometer meter R1407) are compared by summing resistors in the range servo amplifier. Any sum, other than zero, of these two voltages is amplified and inverted by voltage amplifier and phase inverter V816, further amplified by voltage amplifier V817, and fed to phase sensitive detector V818. The dc output level from V818 changes the dc operating level of magnetic amplifier driver V819. This changes the direct current through magnetic amplifier T807. The unbalance in the magnetic amplifier will drive range servo motor B1401 to a position where the sum of the two input voltages to the range servo amplifier is zero, by mechanically positioning RHO potentiometer R1407. Mechanical coupling to B1401 and R1407 sets the range digital counter and plotting board indicator at the map range.

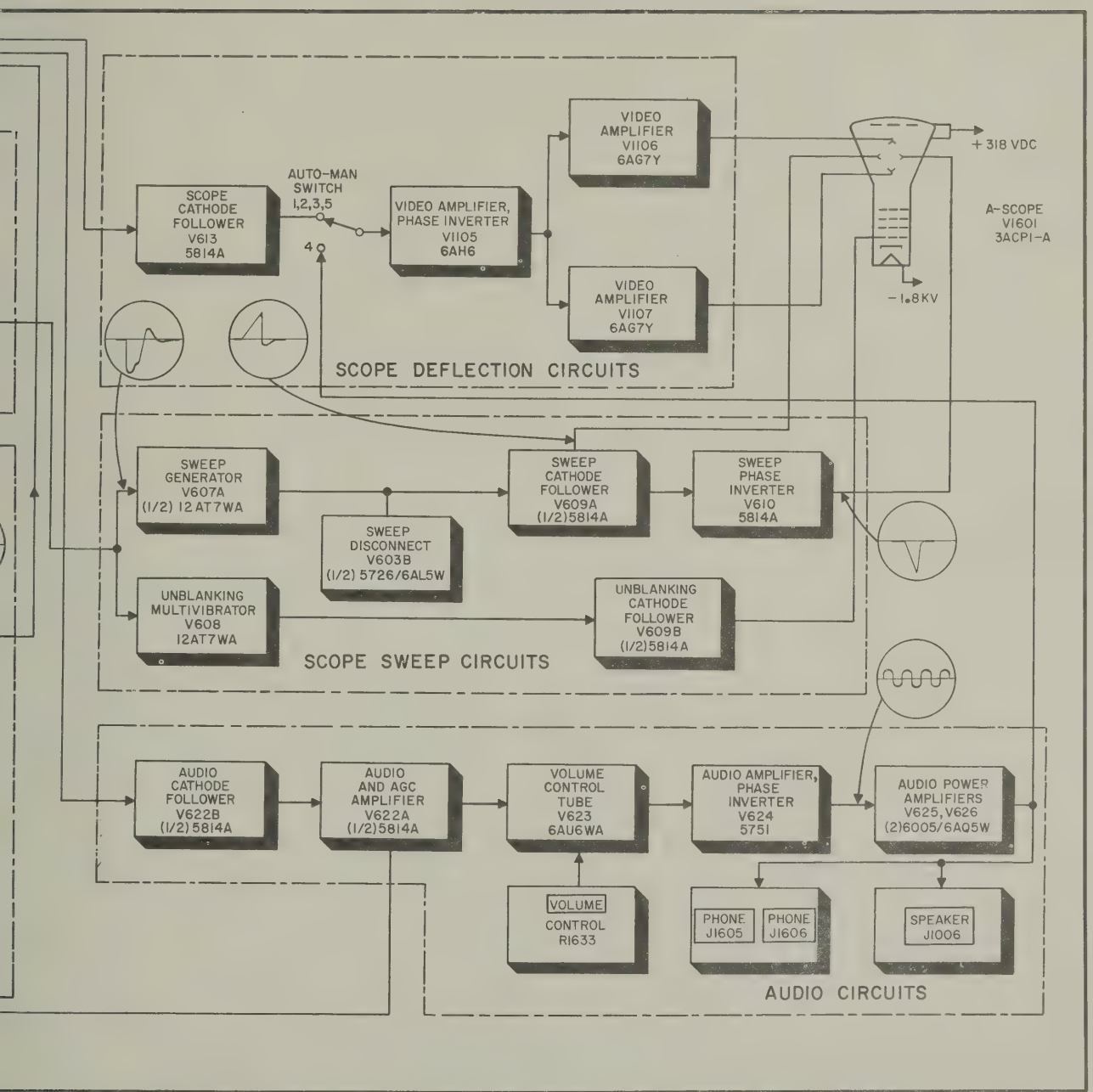
c. Azimuth Resolver Circuits. The azimuth resolver circuits convert map range information and antenna azimuth position information into X and Y map coordinates. The actual conversion is accomplished by azimuth resolver B1302. A voltage, corresponding to map range, from the elevation resolver circuits provides one input to difference amplifier V1103A. The other input to V1103A is furnished by B1302 compensator windings (voltage from compensator windings varying with stator windings voltage). The difference voltage is amplified by V1103 and coupled to azimuth resolver driver V1104, which feeds the stator of B1302. The stator voltage induces a voltage on the rotor, the amplitude of which varies sinusoidally with rotor position. The rotor of B1302 is mechanically coupled to the AZIMUTH COUNTER; therefore, rotating the counter (by the AZIMUTH crank or sector scan motor) displaces the rotor. The output voltages (from B1302 rotor) supplies the X and Y map coordinate information to the X and Y servo amplifiers in the X and Y map coordinate circuits.

d. X and Y Map Coordinate Circuits. The X and Y map coordinate circuits are separate but identical and this discussion applies to both. The resolved map range and azimuth information from the azimuth resolver circuits and the actual servo position (given by the voltage from X or Y potentiometer R1503 or R1553) are compared by summing resistors in the servo amplifier. Any sum other than zero of these two voltages is fed to voltage amplifier phase inverters V804 and V812. The signal is then amplified by voltage amplifiers V805 and V813 and fed to phase sensitive detectors V806 and V814. The dc output level from the phase sensitive detector changes the dc operating level of magnetic amplifier drivers V807 and V815. This changes the direct current through magnetic amplifiers T804 and T806. The unbalance in the magnetic amplifier will drive the X or Y servo motor (B1501 or B1551) to a position where the sum of the two input voltages to the servo amplifier is zero by mechanically positioning the X or Y potentiometer. The X and Y digital counters (M1501 and M1551) will indicate the map coordinates through mechanical coupling to the respective servo motors.

46. Power System

a. Ac Power Distribution Circuits. The engine generator supplies 115-volt, 400-cycle ac power to the MAIN circuit breaker in the shelter distribution box (when shelter is used) which distributes the power to the shelter lights, heater, ac receptacles, and ventilators through the SHELTER circuit breaker. The RADAR circuit breaker controls the power to the radar set proper. When the radar set is used without the shelter, the engine generator supplies the 115-volt, 400-cycle ac power directly to the power supply unit. The ON-OFF switch on the front panel of the power supply unit supplies ac power to all units of the radar set. The line voltage may be read on meter M801, on the front panel of the coordinator unit.

b. Operator's Site Dc Power Circuits. Power is received from the ac power distribution circuits to feed the scope and low voltage supplies. The scope power supply furnishes −1,800 volts unregulated for the range scope. The low voltage supplies furnish +258 volts dc, +250 volts dc, +150 volts dc, and −108 volts dc regulated outputs. The unregulated low voltage dc outputs


SCOPE CATHODE FOLLOWER V613 5814A
AUTO-MAN SWITCH 1,2,3,5
4
VIDEO AMPLIFIER, PHASE INVERTER V1105 6AH6
VIDEO AMPLIFIER V1106 6AG7Y
VIDEO AMPLIFIER V1107 6AG7Y
+318 VDC
A-SCOPE V1601 3ACP1-A
-1.8KV
SCOPE DEFLECTION CIRCUITS
SWEEP GENERATOR V607A (1/2) 12AT7WA
SWEEP DISCONNECT V603B (1/2) 5726/6AL5W
SWEEP CATHODE FOLLOWER V609A (1/2)5814A
SWEEP PHASE INVERTER V610 5814A
UNBLANKING MULTIVIBRATOR V608 12AT7WA
UNBLANKING CATHODE FOLLOWER V609B (1/2)5814A
SCOPE SWEEP CIRCUITS
AUDIO CATHODE FOLLOWER V622B (1/2) 5814A
AUDIO AND AGC AMPLIFIER V622A (1/2)5814A
VOLUME CONTROL TUBE V623 6AU6WA
AUDIO AMPLIFIER, PHASE INVERTER V624 5751
AUDIO POWER AMPLIFIERS V625, V626 (2)6005/6AQ5W
VOLUME CONTROL R1633
PHONE J1605
PHONE J1606
SPEAKER J1006
AUDIO CIRCUITS

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46. Power System

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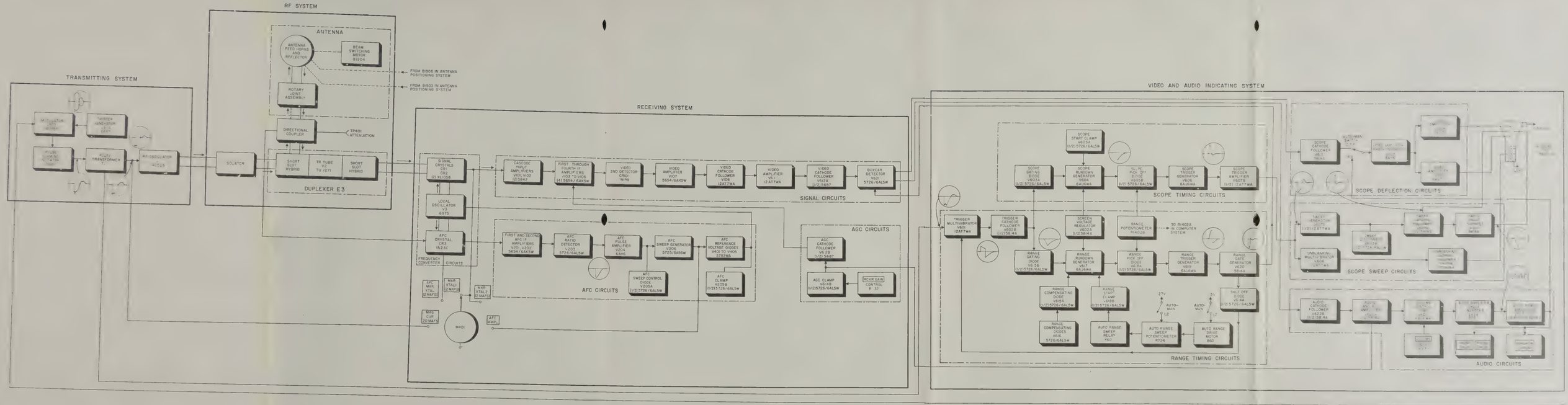
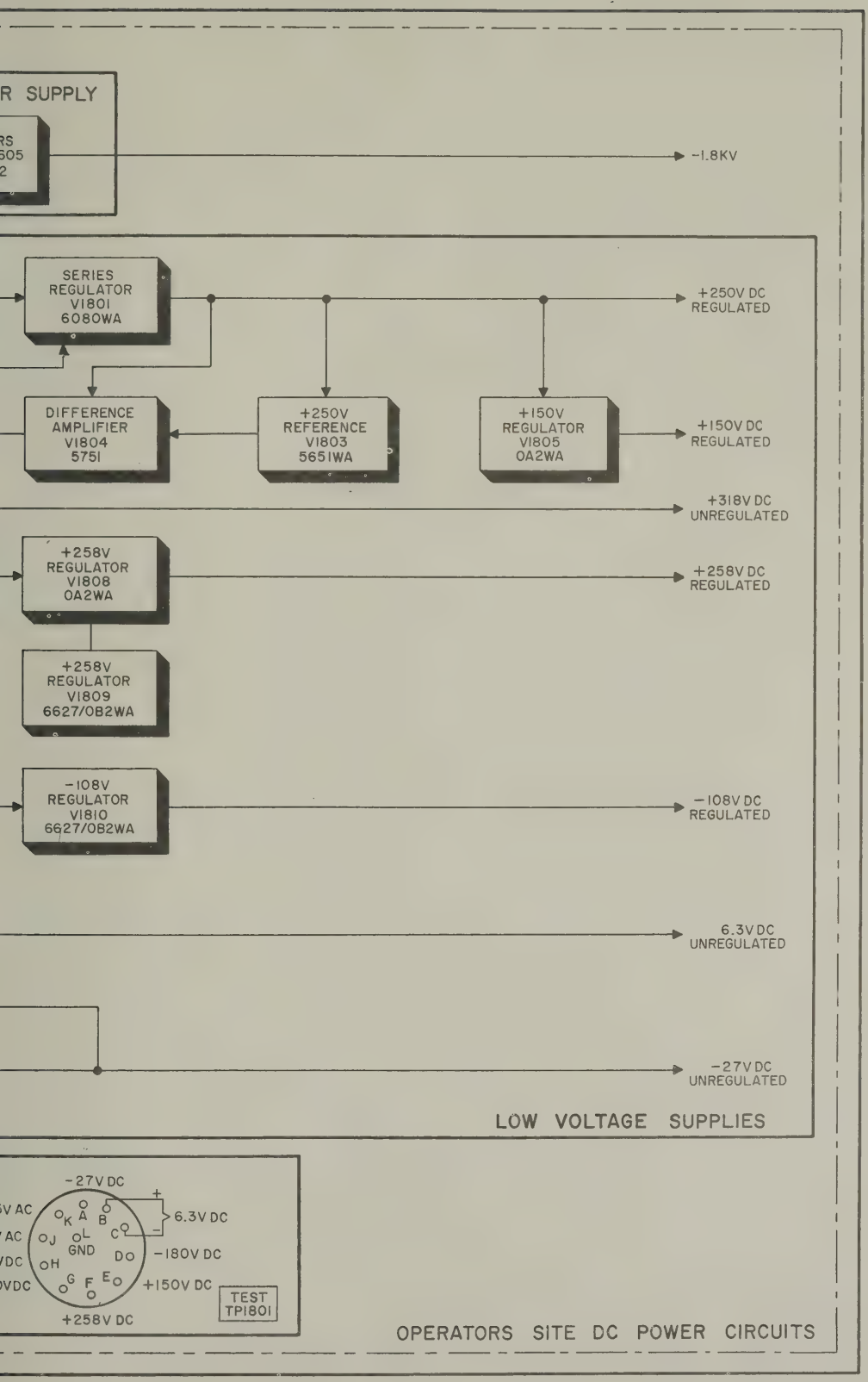

RF SYSTEM
ANTENNA
ANTENNA FEED HORNS AND REFLECTOR
BEAM SWITCHING MOTOR B1904
FROM B1905 IN ANTENNA POSITIONING SYSTEM
FROM B1905 IN ANTENNA POSITIONING SYSTEM
ROTARY JOINT ASSEMBLY
DIRECTIONAL COUPLER
TP401 ATTENUATION
TRANSMITTING SYSTEM
MODULATOR
MODULATOR HEINGAUGE
PULSE FORMING NETWORK
PULSE TRANSFORMER
RF OSCILLATOR
ISOLATOR
SHORT SLOT HYBRID
TR TUBE V2 TU 1271
SHORT SLOT HYBRID
DUPLEXER E3
RECEIVING SYSTEM
SIGNAL CRYSTALS CR1 CR2 (2) XL1058
LOCAL OSCILLATOR V3 6975
AFC CRYSTAL CR3 1N23C
FREQUENCY CONVERTER CIRCUITS
CASCODE INPUT AMPLIFIERS V101 V102 (2) 5842
FIRST THROUGH FOURTH IF AMPLIFIERS V103 TO V106 (4) 5654/6AK5W
VIDEO 2ND DETECTOR CR10 1N76
VIDEO AMPLIFIER V107 5654/6AK5W
VIDEO CATHODE FOLLOWER V108 12AT7WA
VIDEO AMPLIFIER V6 = 12AT7WA
VIDEO CATHODE FOLLOWER V6128 (1/2) 5687
BOXCAR DETECTOR V621 5726/6AL5W
SIGNAL CIRCUITS
FIRST AND SECOND AFC IF AMPLIFIERS V201, V202 5654/6AK5W
AFC RATIO DETECTOR V203 5726/6AL5W
AFC PULSE AMPLIFIER V204 6AH6
AFC SWEEP GENERATOR V206 5725/6A6W
AFC REFERENCE VOLTAGE DIODES V403 TO V405 5783WA
AFC SWEEP CONTROL DIODE V205A (1/2) 5726/6AL5W
AFC CLAMP V407 (1/2) 5726/6AL5W
AFC CIRCUITS
AGC CIRCUITS
AGC CATHODE FOLLOWER V6-B (1/2) 5687
AGC CLAMP V6-A (1/2) 5726/6AL5W
RCVR GAIN CONTROL R 32
AFC MXR XTAL 2 MAF58
MXR XTAL 1 2 MAF58
MXR XTAL 2 2 MAF58
MAG CUR 20 MAF58
M401
AFC AMPL
VIDEO AND AUDIO INDICATING SYSTEM
SCOPE START CLAMP V6034 (1/2) 5726/6AL5W
SCOPE GATING DIODE V6-5B (1/2) 5726/6AL5W
SCOPE RUNDOWN GENERATOR V604 6AU6W
SCOPE PICK OFF DIODE V6-6B (1/2) 5726/6AL5W
SCOPE TRIGGER GENERATOR V606 6AU6W
SCOPE TRIGGER AMPLIFIER V607B (1/2) 12AT7WA
SCOPE TIMING CIRCUITS
TRIGGER MULTIVIBRATOR V601 12AT7WA
TRIGGER CATHODE FOLLOWER V602B (1/2) 5687
SCREEN VOLTAGE REGULATOR V602A (1/2) 5841
RANGE POTENTIOMETER R1402-B
TO R1402A IN COMPUTER SYSTEM
RANGE GATING DIODE V6-5B (1/2) 5726/6AL5W
RANGE RUNDOWN GENERATOR V607 6AU6W
RANGE PICK OFF DIODE V6-6B (1/2) 5726/6AL5W
RANGE TRIGGER GENERATOR V608 6AU6W
RANGE GATE GENERATOR V610 6BA6
RANGE COMPENSATING DIODE V609A (1/2) 5726/6AL5W
RANGE CLAMP V6-8B (1/2) 5726/6AL5W
27V
AUTO-MAN
1.2
AUTO-MAN
SHUT OFF DIODE V6-4A (1/2) 5726/6AL5W
RANGE COMPENSATING DIODE V609B (1/2) 5726/6AL5W
AUTO RANGE SWEEP RELAY K602
AUTO RANGE SWEEP POTENTIOMETER R724
AUTO RANGE DRIVE MOTOR B60
RANGE TIMING CIRCUITS
SCOPE CATHODE FOLLOWER V6-1 (1/2) 5965
SCOPE DEFLECTION CIRCUITS
SCOPE SWEEP CIRCUITS
AUDIO CATHODE FOLLOWER V622B (1/2) 5718-6A
AUDIO CIRCUITS

Figure 57. Radar Set AN/TPS-25, complete block diagram.



NOTES.

1. ALL WAVEFORMS TAKEN AT RANGE OF 14,000 METERS.
2. SERVO AMPLIFIER WAVEFORMS TAKEN WITH ANTENNA AT NULL POSITION AND AZIMUTH AND ELEVATION COUNTERS AT ZERO MILS.

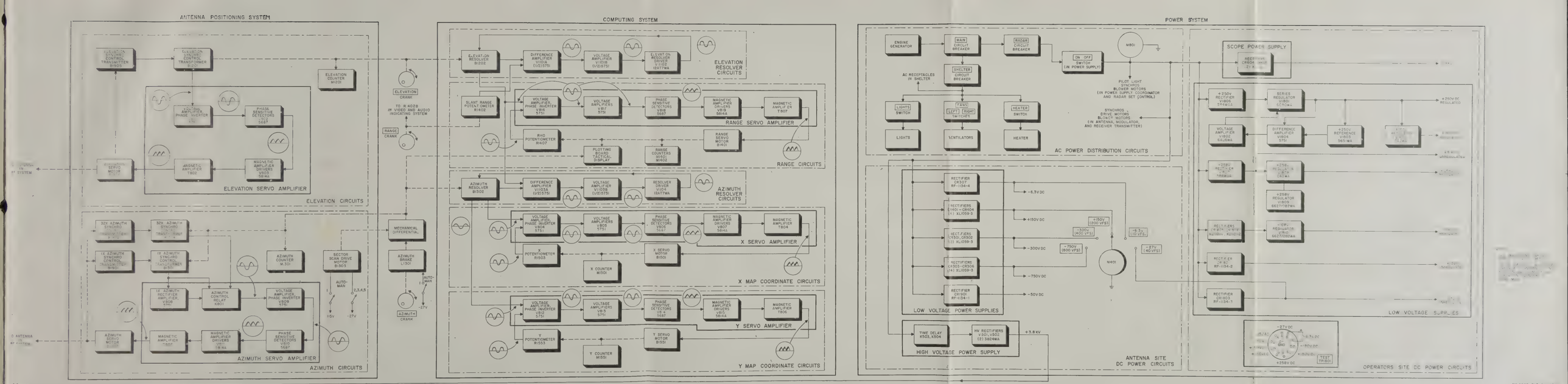


Figure 37.—Continued.

are +318 volts dc, −27 volts dc, and 6.3 volts dc. Voltage measurement of the output of the low voltage supplies can be made with an external voltmeter at TEST point TP1801, on the front panel of the power supply unit.

c. Antenna Site Dc Power Circuits. Power is received from the ac power distribution circuits to feed the low and high voltage power supplies. The low voltage power supplies furnish +150 volts dc, −6.3 volts dc, −300 volts dc, and −750 volts dc unregulated outputs. The above voltages and the −27-volt dc output, of the operators site dc power circuits can be read on meter M401 (on the front panel of the receiver-transmitter unit) by switching the meter switch to the correct position. The high voltage power supply contains a time delay circuit that prevents the high voltage from being applied (for approximately 5 minutes) to the modulator, until the filaments in the transmitting circuit have warmed up.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE

47. Disassembly

Refer to paragraphs 104 through 111, TM 11–5840–217–10, Operator's Manual, for procedures on disassembly of Radar Set AN/TPS–25.

48. Repackaging for Shipment or Limited Storage

Repackaging the unit for shipment or limited storage consists of repacking and crating the shelter. If possible, use the crate salvaged during unpacking (par. 29, TM 11–5840–217–10).

a. Material Requirements. The wood, nails, and bolts listed below are required to construct a new crate for Radar Set AN/TPS–25 if the original shipping crate is unavailable. The waterproof tape and the desiccant are required for oversea shipment.

Material	Quantity
Wood 4 x 4 (fir)	55 feet.[a]
Wood 2 x 6 (fir)	94 feet.[b]
Wood 2 x 4 (fir)	390 feet.[c]
Wood 1 x 12 (pine)	150 feet.[d]
Wood 1 x 6 (pine)	15 feet.[e]
10 penny cement-coated nails	20 pounds.
Carriage bolts, ½ x 7 inch	12.
Steel strap (1 inch)	30 feet.
Desiccant (selica gel)	800 units.
Waterproof tape (3-inch) (JAN–P–127, grade A).	50 feet.

[a] 3 pieces 123 inches, 2 80 inches, 2 40 inches and 1 46½ inches long.
[b] 14 pieces 80 inches long.
[c] 6 pieces 123½ inches, 2 116½ inches, 2 107 inches, 4 100 inches, 4 88 inches, 8 86 inches, 2 80 inches, 6 76¾ inches, 13 73 inches, and 6 70½ inches long.
[d] 10 pieces 85⅞ inches, 6 84 inches, and 5 81½ inches long.
[e] 2 pieces approximately 90 inches long.

b. Shipments. Prepare the radar set for shipment as follows:

(1) Make a complete check of the radar set as described in paragraph 13.

(2) Disassemble the radar set (par. 47). Clean all the components and check that radar set is complete (par. 5*a*, TM 11–5840–217–10).

Note. If radar set is to be shipped uncrated, remove the shelter tiedown cables from the accessory box. If uncrated equipment is to be loaded on transporting vehicle by hoisting, also remove the hoisting cable assembly.

(3) Repack the components in the shelter (par. 113–116, TM 11–5840–217–10).

***Caution:* If the equipment is to be subject to high altitudes during shipment, one ventilation port on the antenna assembly, receiver-transmitter, modulator, coordinator, radar set control, and power supply units must be left open before packing in shelter.**

(4) Use the salvaged crate, or the material in *a* above, and crate and tie down (using 1-inch steel strap) the shelter in accordance with figure 23, TM 11–5840–217–10, Operator's Manual.

Note. If the equipment is being prepared for oversea shipment, distribute the desiccant in the shelter by tying packages to the units. Use the waterproof tape and seal the edges of all doors, ports, window, and the gasoline overflow line before crating the shelter.

(5) Use a fork lift or power winch with skids and load the crated shelter on the transporting vehicle.

Note. If the equipment is shipped uncrated, loading can be accomplished by hoisting.

Attach the hoisting cable (see *note* above) to the upper hole in the four lifting brackets (fig. 37, TM 11–5840–217–10). Tie down the uncrated shelter on the transporting vehicle with the four tiedown cables (see *note* above) attached to the lower hole in the lifting brackets.

c. Limited Storage. When the equipment is to be stored for a limited time, follow the procedures below:

(1) Inventory all components, tools, spare parts, and test equipment to make sure that equipment is complete and serviceable.

(2) Make a complete check of the radar set as described in paragraph 13. Repair or replace any unserviceable parts or components.
(3) Disassemble the radar set (par. 47).
(4) Empty both gasoline tanks (on forward wall of shelter).
(5) Thoroughly clean the equipment by using cleaning compound and clean cloths. Clean the air filters, diffusing grilles, screening, and sediment bowl as described in paragraphs 6, 7, and 8.
(6) Remove all rust spots by using abrasive cloth and sandpaper. Repaint bared metal with primer and finish paints.
(7) Prepare the engine generator for limited storage (TM 11–6115–203–12).
(8) Repackage for shipment (*b* above).

APPENDIX I

REFERENCES

Following is a list of references applicable and available to the unit repairman of Radar Set AN/TPS–25:

TM 11–6115–203–12	Gasoline Engine Generator Set PU–450/G, Operation and Organizational Maintenance.
TM 11–5840–217–10	Radar Set AN/TPS–25, Operator's Manual.
Technical manual packed with equipment.	Operational and Organizational Maintenance (Hunter Gasoline Heater Model UH–47–4S).
TM 11–5527	Multimeter TS–352/U, TS–352A/U and TS–352B/U.
TM 11–5083	Test Set, Electron Tube TV–7/U.

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APPENDIX II

MAINTENANCE ALLOCATION CHART

1. General

a. The maintenance allocation chart assigns maintenance functions and repair operations to be performed by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* Only the nomenclature or standard item name is shown in this column. Additional descriptive data are included only where clarification is necessary to identify the part. Components and parts comprising a major end item are listed alphabetically. Assemblies and subassemblies are in alphabetical sequence with their components listed alphabetically immediately below the assembly listing.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelon capable of performing the operation. These are defined as follows:

(*a*) *Service.* To clean, to preserve, and to replenish fuel and lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(*e*) *Replace.* To substitute serviceable assemblies, subassemblies, and parts for unserviceable components.

(*f*) *Repair.* To restore to a serviceable condition by replacing unserviceable parts or by any other action required utilizing tools equipment, and skills available, to include welding, grinding, riveting, straightening, adjusting, etc.

(*g*) *Aline.* To adjust two or more components of an electrical system so that their functions are properly synchronized.

(*h*) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(*i*) *Rebuild.* To restore to a condition comparable to new by disassembling the item to determine the condition of its component parts and reassembling it using serviceable, rebuilt, or new assemblies, subassemblies, and parts.

(3) *1st, 2d, 3d, 4th, 5th echelon.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment listed in the maintenance allocation chart. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column clarify data in the preceding columns.

c. Columns in the allocation of tools for maintenance functions chart are defined as follows:

(1) *Tools required for maintenance functions.* This column lists tool, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, 5th echelon.* A dagger (†) symbol indicates the echelons allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

(4) *Remarks.* Entries in this column clarify data in the other columns.

2. Maintenance by Using Organizations

When this equipment is used by signal service organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

3. Mounting Hardware

The basic entries of this maintenance allocation chart do not include mounting hardware such as screws, nuts, bolts, washers, brackets, clamps, etc.

4. Comments or Suggestions

Any comments concerning omissions and discrepancies in this maintenance allocation chart will be prepared on DA Form 2028 and forwarded direct to Commanding Officer, U.S. Army Signal Equipment Support Agency, Fort Monmouth, N.J., ATTN: SIGFM/ES–M.

MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
RADAR SET AN/TPS-25								
	replace		X					
	repair			X				
	rebuild					X		
ANTENNA AS-981/TPS-25	service		X				23	
	inspect		X					
	test			X	X	X	1,22	
	replace		X					
	repair			X				
	rebuild					X		
ACTUATOR	replace			X				
	repair				X			
	rebuild					X		
BEARING	replace			X				
CAPACITOR	replace			X				
CONNECTOR	replace			X				
COUPLER, ROTARY	replace			X				
	repair				X			
	rebuild					X		
COUPLING	replace			X				
COVER	replace			X				
HOIST	replace		X					
	repair			X				
	rebuild				X			
HORN	replace				X			
INSERT	replace			X				
MOTOR, AC	test			X			1,22	
	replace			X				
	repair				X			
	rebuild					X		
MOTOR, CONTROL	test			X			1	
	replace			X				
	repair				X			
	rebuild					X		
RADOME	replace			X				
	repair				X			
	rebuild					X		

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
RECTIFIER	test			X			1,3	
	replace			X				
REFLECTOR	replace			X				
RELAY	test			X			1	
	replace			X				
RING	replace			X				
SCREW	replace			X				
SOLENOID	test			X			1	
	replace			X				
SPRING	replace				X			
STOP	replace				X			
SWITCH ASSEMBLY	replace				X			
	rebuild					X		
SWITCH, SENSITIVE	replace			X				
SYNCHRO	test			X			1	
	replace			X				
	repair				X			
	rebuild					X		
TERMINAL BOARD	replace			X				
WAVEGUIDE ASSEMBLY	replace			X				
	repair				X			
	rebuild					X		
ATTENUATOR	replace			X				
CABLE ASSEMBLY	test			X			1,22	
	replace		X					
	repair			X				
	rebuild					X		
CABLE, RADIO FREQUENCY	test			X			1,22	
	replace			X				
CONNECTOR	replace			X				
	repair				X			
	rebuild					X		

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
CONTROL, RADAR SET C-2715/TPS-25	service	X						
	adjust	X						Operational only
	inspect	X						Visual
	test			X			2,3,10,11,12	No. 4 at 5th echelon
	replace	X						
	repair			X			22	
	align			X			2,3,10,11,12	No. 4 at 5th echelon
	calibrate			X			2,3,10,11,12	No. 4 at 5th echelon
	rebuild					X		
ADAPTER, SWITCH ACTUATOR	replace			X			22	
ARM, SWITCH ACTUATOR	replace			X			22	
BEZEL	replace			X			22	
BEARING	replace					X		Shop facilities
BOOT, DUST AND MOISTURE SEAL	replace			X			22	
BRACKET	replace			X				
	rebuild					X		
BRAKE, ELECTRICAL	replace			X			22	
BUSHING	replace					X		
	rebuild					X		
CABLE ASSEMBLY	replace		X					
	repair			X			22	
	rebuild			X			22	
CABLE	replace			X			22	
CONNECTOR	replace			X			22	
CAPACITOR	replace			X			22	
CATCH, LUGGAGE	replace			X			22	
CHASSIS SUB-ASSEMBLY	replace			X			22	
	repair					X		
CLAMP	replace			X			22	
COIL, RF	test			X			1	
	replace			X			22	
CONTACT, ELECTRICAL	replace			X			22	
CONTROL SUB-ASSEMBLY	replace			X			22	
	repair					X		Shop facilities
COUNTER, ROTATING	replace			X			22	
COUPLING	replace			X			22	

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
COVER	replace			X			22	
	repair				X			Shop facilities
DIAL, CONTROL	replace			X			22	
DIFFERENTIAL, RADAR SET CONTROL	replace			X			22	
ELECTRON TUBE	test		X				3	
	replace		X					
EYELET, METALLIC	replace			X			22	
FERRULE	replace			X			22	
FILTER, AIR CONDITIONING	replace			X			22	
FUSE, CARTRIDGE	test		X				1	
GASKET	replace			X			22	
HOLDER, BEARING	replace			X				
	rebuild					X		Shop facilities
HOUSING	replace			X			22	
	repair					X		Shop facilities
INSERT, SCREW THREAD	replace			X			22	
INSULATOR	replace			X			22	
JACK	replace			X			22	
KNOB	replace			X			22	
LAMP, GLOW	replace			X			22	
LAMP, INCANDESCENT	replace		X					
LIGHT, INDICATOR	replace			X				
MOTOR	test			X			1	
	replace			X			22	
RELAY ARMATURE	test			X			1	
	replace			X			22	
RESISTOR	test			X			1	
	replace			X			22	
RESOLVER, ELECTRICAL	replace			X			22	
	repair				X			Shop facilities
RETAINER	replace			X			22	
RING, RETAINING	replace			X			22	
SCREW	replace			X			22	
SEAL, PLAIN ENCASED	replace			X			22	
SHIELD, ELECTRON TUBE	replace		X					
SHIM	replace			X			22	
SHUTTER, DIAL	replace			X			22	

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
SLEEVE	replace			X			22	
SOCKET, ELECTRON TUBE	replace			X			22	
SPACER	replace			X			22	
SPRING	replace			X			22	
STUD	replace			X			22	
SWITCH	replace			X			22	
SYNCHRO, CONTROL TRANSFORMER	test			X			1	
	replace			X			22	
	repair				X			Shop facilities
TERMINAL BOARD	replace			X			22	
	repair				X			Shop facilities
	rebuild				X			Shop facilities
UNIVERSAL JOINT	replace			X			22	
WASHER	replace			X			22	
COORDINATOR SN-231/TPS-25	service							1. This unit cannot be tested without the complete system, as it is an intergral part of the system.
	test			X			1,2,3,8,22	2. Continuity, resistance, tubes, voltages only
	replace	X						
	repair			X				
	align			X				3. System check
	calibrate			X				System check
	rebuild					X		
ARM, SWITCH ACTUATOR	replace			X			22	
	rebuild					X	22	
BOOT, DUST AND MOISTURE SEAL	replace			X			22	
CAPACITOR	test			X			1	
	replace			X			22	
CASE	replace			X				
	repair					X		
	rebuild					X		
CATCH, LUGGAGE	replace			X			22	
	repair					X		Depot facilities
CHAIN, WELDLESS	replace			X			22	
	repair			X			22	
CLIP, SPRING TENSION	replace			X			22	
CONNECTOR, RECEPTACLE, ELECTRICAL	replace			X			22	
	repair			X			22	
CONTACT, ELECTRICAL	replace			X			22	

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
COUPLING	replace			X			22	
COVER, AIR VENT	replace			X			22	
	repair				X			Shop facilities
COVER, ELECTRICAL CONNECTOR	replace		X					Screwdriver
ELECTRON TUBE	test		X					
	replace		X					
EYELET:	replace			X			22	
FAN, AXIAL	replace			X				
	repair				X			Shop facilities
	rebuild					X		Shop facilities
FILTER	replace			X			22	
FUSE, CARTRIDGE	test		X				1	
	replace		X					
FUSEHOLDER	replace			X				
GASKET	replace			X				
	rebuild					X		Depot fabrication
HOOD, AIR VENT	replace			X			22	
	repair				X			Shop facilities
	rebuild					X		Shop facilities
INSERT, SCREW THREAD	replace			X				
INSULATOR	replace			X			22	
	rebuild					X		Depot facilities
JACK, TELEPHONE	replace			X			22	
LAMP, INCANDESCENT	replace		X					
LAMPHOLDER	replace			X			22	
MOTOR AC	test			X			1	
	replace			X			22	
	repair				X			Shop facilities
OVEN, TUNED CIRCUIT	test			X			1	
	replace			X			22	Sealed unit
REACTOR	replace			X			22	
RELAY, ARMATURE	test			X			1	
	replace			X			22	
RESISTOR	test			X			1	
	replace			X			22	
RETAINER	replace			X			22	
RING, RETAINING	replace			X			22	

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(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
SATURABLE REACTOR	replace			X			22	
SCREW	replace			X			22	
SEAL, PLAIN ENCASED	replace			X			22	
SEMI-CONDUCTOR DEVICE, DIODE	test			X			1	
	replace			X			22	
SHIELD, ELECTRON TUBE	replace		X					
SHIM	replace			X			22	
SOCKET, ELECTRON TUBE	replace			X			22	
SPRING	replace			X			22	
STRAP NUT, ELECTRON TUBE SOCKET	replace			X			22	
STUD	replace			X			22	
SWITCH	test			X			1	
	replace			X			22	
TERMINAL BOARD	replace			X			22	
	rebuild					X		Shop facilities
TRANSFORMER	test			X			1	
	replace			X			22	
VOLTMETER	test					X		Instrument shop
	replace			X			22	
	repair					X		Instrument shop
EXTENSION, SOCKET WRENCH	replace		X					
GENERATOR SET, GASOLINE ENGINE: PU-450/G	service							Separate MAC
	replace		X					
	repair			X				
	rebuild					X		
GUY	replace		X					
	repair			X				
	rebuild					X		
HEADSET, ELECTRICAL H-171/G	replace		X					
	repair			X				
	rebuild					X		
JACK, TELEPHONE	replace			X				
KNOB	replace			X				
LOUDSPEAKER LS-451/G	replace		X					
	repair			X				
	rebuild					X		
LOUDSPEAKER, PERMANENT MAGNET	replace			X				

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
MAST	replace		X					
	repair			X				
	rebuild					X		
MODULATOR, RADAR MD-344/TPS-25	service	X						Preventive maintenance
	adjust	X						Operational only
	inspect	X						Visual
	test		X				1,2	Tubes fuses pluck out items
	replace	X						
	repair			X				
	align			X			1,2,3,7,8,11,14 15,22	
	calibrate			X			1,2,3,7,8,11,14 15,22	
	rebuild				X			
	test			X			1,2,3,7,8,11 14,15,22	
CAPACITOR	replace			X			22	
CONNECTOR, RECEPTACLE	replace			X			22	
	repair			X			22	
	rebuild				X		22	
COVER, ELECTRICAL CONNECTOR	replace		X				22	
	repair		X				22	
DELAY LINE (Network, Pulse forming)	test			X			1,8	
	replace			X			22	
ELECTRON TUBE	test		X				3	
	replace		X					
EYELET	replace			X			22	
FAN, AXIAL	replace			X			22	
	repair			X			22	
	rebuild				X		22	
FILTER, AIR CONDITIONING	replace		X					
FILTER RF	test			X			1	
	replace			X			22	
FUSE	test		X				1	
	replace	X						
FUSEHOLDER	replace			X			22	
	repair			X			22	
	rebuild			X			22	

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
GAP, SAFETY	replace			X				
GASKET	replace		X				22	
GROMMET, RUBBER	replace		X					
INSERT, SCREW THREAD	replace			X				
INSULATOR, STANDOFF	replace			X			22	
JACK, TIP	replace			X			22	
LATCH	replace		X				22	
PIN, SPRING (Roll Pin)	replace			X			22	
REACTOR	replace			X			22	
RELAY	test			X			1	
	replace			X			22	
RESISTOR	replace			X			22	
RETAINER, ELECTRON TUBE	replace		X				22	
RETAINER, CAPACITOR	replace			X			22	
SCREW	replace			X			22	
SEAL	replace			X			22	
SEMI-CONDUCTOR DEVICE, DIODE	test			X			1	
	replace			X			22	
SHIELD, ELECTRON TUBE	replace		X					
SOCKET, ELECTRON TUBE	replace			X			22	
STRAP NUT	replace			X			22	
STUD, PIVOT	replace		X					
	repair			X			22	
	rebuild			X			22	
TRANSFORMER	test			X			1	
	replace			X			22	
PACKING, PREFORMED	replace			X				
PIN	replace			X				
PLOTTING BOARD, TACTICAL DISPLAY PT-441/TPS-25	service	X						
	adjust	X						Operational only
	inspect	X						
	test			X			1,22	Operating AN/TPS-25
	replace	X						
	repair				X			Shop facilities
	align			X				
	rebuild					X		Depot facilities
ADAPTER, SWITCH ACTUATOR	replace			X			22	

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
BEARING, BALL, ANNULAR	replace				X			Shop facilities
BEARING, SLEEVE	replace				X			Shop facilities
BLOCK, GUIDE	replace				X			Shop facilities
BOLT	replace			X			22	
BRACKET	replace			X			22	
BUSHING	replace				X			Shop facilities
CAM, STOP	replace				X			Shop facilities
CATCH, STOP	replace				X			Shop facilities
CLAMP	replace				X			Shop facilities
CLIP, SPRING TENSION	replace				X			Shop facilties
COLLAR, SHAFT	replace				X			Shop facilities
CONNECTOR, RECEPTACLE, ELECTRICAL	replace			X			22	
COUNTERWEGHT, ARM	replace				X			Shop facilities
COUPLING, ASSEMBLY, PLOTTING BOARD	replace				X			Shop facilities
COUPLING, SHAFT RIGID	replace				X			Shop facilities
COVER	replace			X			22	
DRIVE TAPE, LIGHT	replace				X			Shop facilities
EYELET, METALLIC	replace			X			22	
GASKET	replace				X			Shop facilities
GEAR ASSEMBLY, PLOTTING BOARD	replace				X			Shop facilities
HEAD, WING	replace			X			22	
HOUSING ASS'Y, LENS	replace			X			22	
	repair				X			Shop facilities
INSERT, SCREW THREAD	replace			X				
KEY, SOCKET HEAD SCREW	replace			X			22	
KNOB	replace			X			22	
LAMP, INCANDESCENT	test		X				1	
	replace			X			22	
LEG, PLOTTING BOARD	replace		X					
	repair				X			Shop facilities
	rebuild				X			Shop facilities
LENS, CONDENSER, PHOTOGRAPHIC	replace				X			Shop facilities
LIGHT ASSEMBLY, PLOTTING BOARD	replace			X			22	
	repair				X			Shop facilities
PIN	replace				X			Shop facilities
PIVOT, CAP	replace				X			Shop facilities
PULLEY, GROOVE	replace				X			Shop facilities

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
RETAINER	replace				X			Shop facilities
ROLLER, GUIDE	replace				X			Shop facilities
RUBBER STRIP	replace			X			22	
SCREW	replace			X			22	
SEAL, PLAIN ENCASED	replace				X			Shop facilities
SHAFT	replace				X			Shop facilities
SHIM	replace				X			Shop facilities
SPACER	replace				X			Shop facilities
SPRING	replace				X			Shop facilities
SPROCKET, WHEEL	replace				X			Shop facilities
SWITCH SENSITIVE	replace			X			22	
THUMBSCREW	replace		X					
WASHER, THRUST	replace				X			Shop facilities
WINDOW, PLASTIC	replace			X			22	
	rebuild				X			Shop facilities
PLUG	replace			X				
POWER SUPPLY PP-2166/TPS-25	service	X						
	adjust	X						Operational only
	inspect	X						Visual
	test			X	X		1,2,3,8,22	1-3 only at second echelon
	replace			X				
	repair			X				
	rebuild					X		
BOOT DUST AND MOISTURE SEAL	replace			X			22	
CAPACITOR	replace			X			22	
CASE	replace			X				
	repair					X		
	rebuild					X		
CATCH, LUGGAGE	replace			X			22	
	repair					X		Depot facilities
CHAIN, WELDLESS	replace			X			22	
	repair			X			22	
CLAMP, AIR FILTER	replace			X			22	
	repair				X			Shop facilities
	rebuild					X		Shop facilities
CONNECTOR, RECEPTCLE, ELECTRICAL	replace			X			22	
	repair			X			22	

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
COVER	replace			X			22	
	repair					X		Depot facilities
	rebuild					X		Depot facilities
ELECTRON TUBE	test		X				3	
	replace			X				
FAN, AXIAL	replace			X			22	
	repair				X			Shop facilities
	rebuild					X		Shop facilities
FILTER	replace			X			22	
FUSE, CARTRIDGE	test		X				1	
	replace		X					
FUSEHOLDER	replace			X			22	
GASKET	replace			X			22	
HOOD, AIR VENT	replace			X			22	
	repair					X		Depot facilities
	rebuild					X		Depot facilities
LAMP, GLOW	test		X				1	
	replace			X			22	
LIGHT, INDICATOR	test		X				1	
	replace			X			22	
NUT	replace			X			22	
POST, BINDING	replace			X			22	
REACTOR	test			X			1	
	replace			X			22	
RECTIFIER, METALLIC	replace			X			22	
RESISTOR	test			X			1	
	replace			X			22	
RETAINER	replace			X			22	
SCREW	replace			X			22	
SEAL, PLAIN ENCASED	replace			X			22	
SEMI-CONDUCTOR DEVICE, DIODE	test			X			1	
	replace			X			22	
SHIELD, ELECTRON TUBE	replace		X					
SHIM	replace			X			22	
	rebuild					X		Shop facilities
SOCKET, ELECTRON TUBE	replace			X			22	
	repair			X			22	

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
STRAP NUT, ELECTRON TUBE SOCKET	replace			X			22	
SWITCH	replace			X			22	
TERMINAL BOARD	replace			X			22	
	repair			X			22	
	rebuild					X		Shop facilities
TRANSFORMER	test			X				
	replace			X			22	
RECEIVER-TRANSMITTER, RADAR RT-500/TPS-25	test			X			1 thru 22	No. 4,6,9,13 at 5th only
	replace		X				22	
	repair			X			22	
	align						1 thru 22	No. 4,6,9,13 at 5th only
	calibrate						1 thru 22	No. 4,6,9,13 at 5th only
	rebuild					X	22	
ADAPTER	replace			X			22	
AMMETER	test			X			1	Instrument shop final test
	replace			X			22	
	calibrate					X		Shop facility
	rebuild					X		
AMPLIFIER	replace			X			22	
	repair			X			22	
	rebuild					X	22	
ARM, SWITCH ACTUATOR	replace			X			22	
	rebuild					X	22	
ATTENUATOR	test			X			1	
	replace			X			22	
BALL, PIVOT	replace			X			22	
BEZEL	replace			X			22	
BOLT	replace			X			22	
BOOT	replace			X			22	
CABLE ASSEMBLY	test			X			1	
	replace		X					
	repair			X			22	
	rebuild				X			Shop facilities
CABLE	test			X			1	
	replace			X			22	
CAP, ELECTRICAL	replace			X				

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
CAPACITOR	test			X			1	
	replace			X			22	
COIL	test			X			1	
	replace			X			22	
CONNECTOR	replace			X			22	
COUPLER	replace			X			22	
COVER	replace		X					
TUBE, ELECTRON	test		X				3	
	replace		X					
EYELET	replace			X			22	
FAN	test			X			1	
	replace			X			22	
FILTER	replace			X			22	
	repair				X		22	
	rebuild					X	22	
FUSE	test		X				1	
	replace		X					
FUSEHOLDER	replace			X			22	
GASKET	replace			X			22	
HEAD, WING	replace		X					
INSERT, PROBE	replace			X			22	
JACK, TIP	replace			X			22	
KNOB	replace			X			22	
LAMP	replace		X					
LIGHT, INDICATOR	replace			X			22	
NUT	replace			X			22	
PACKING, PREFORMED	replace			X			22	
PANEL, INDICATOR	replace			X			22	
PIN	replace			X			22	
PLUG, TIP	replace			X			22	
PROBE	replace			X			22	
REACTOR	test			X			1	
	replace			X			22	
RECTIFIER, METALLIC	test			X			1	
	replace			X			22	
RESISTOR	test			X				
	replace			X			22	

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(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
RETAINER	replace			X			22	
SCREW	replace			X			22	
SEMI-CONDUCTOR DEVICE	test			X			1	
	replace			X			22	
SHAFTLOCK	replace			X			22	
SHIELD, TUBE	replace		X					
SHIELDING, GASKET ELECTRONIC	replace			X			22	
SOCKET, TUBE	replace			X			22	
SPACER	replace			X			22	
SPRING	replace			X			22	
SWITCH ASSY	replace			X			22	
TERMINAL BOARD	replace			X			22	
TRANSFORMER	test			X			1	
	replace			X			22	
WAVE GUIDE	replace			X			22	
REEL, CABLE	replace		X					
RING, RETAINING	replace			X				
ROD, GROUND	replace		X					
SHELTER, ELECTRICAL EQUIPMENT S-124/G	test			X			1,22	
	replace			X				
	repair				X			
	rebuild					X		
ADAPTER	replace		X					
BOLT	replace			X				
CABLE ASSEMBLY	test			X			1,22	
	replace		X					

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH.	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
AN/TPS-25 (continued)								
CABLE	test			X			1, 22	
	replace			X				
CAN, GASOLINE	replace	X						
CAPACITOR	replace			X				
CASE, CABLE ASSEMBLY	replace	X						
CIRCUIT BREAKER	test			X			1	
	replace			X				
CONNECTOR	replace			X				
EXTINGUISHER, FIRE	replace	X						
FAN	test			X			1, 22	
	replace			X				
	repair				X			
	rebuild					X		
HEATER	test		X				1, 23	
	replace	X						
LAMP	replace	X						
LIGHT, DOME	replace			X				
SWITCH	replace			X				
TERMINAL BOARD	replace			X				
SOCKET, WRENCH	replace		X					
WAVEGUIDE ASSEMBLY	replace			X				
	repair				X			
	rebuild					X		
WRENCH	replace		X					

ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH.	(3) 2ND ECH.	(4) 3RD ECH.	(5) 4TH ECH.	(6) 5TH ECH.	(7) TOOL CODE	(8) REMARKS
AN/TPS-25 (continued)							
MULTIMETER TS-352/U		†				1	Multimeter TS-352/U will be replaced by Multimeter AN/URM-105 when available
VACUUM TUBE VOLTMETER TS-505/U			†	†	†	2	
TUBE TESTER TV-7/U		†	†	†		3	
TUBE TESTER TV-2/U					†	4	
AUDIO OSCILLATOR TS-382A/U			†	†	†	5	
SIGNAL GENERATOR TS-452B/U			†	†	†	6	
RADAR TEST SET TS-147B/UP			†	†	†	7	
OSCILLOSCOPE AN/USM-50			†	†	†	8	
SPECTRUM ANALYZER TS-148/UP					†	9	
RANGE CALIBRATOR AN/UPM-11A			†	†	†	10	
DUMMYLOAD DA-148/U			†	†	†	11	
SIGNAL GENERATOR TS-497/URR			†	†	†	12	
WHEATSTONE BRIDGE ZM-4B/U					†	13	
PULSE GENERATOR AN/UPM-15			†	†	†	14	
VOLTAGE DIVIDER TS-265/UP			†	†	†	15	
NOISE SOURCE KAY ELECTRIC No. 291A POWER SUPPLY FOR ABOVE KAY ELECTRIC No. 322B			†	†	†	16	No camparable signal corp equipment. This is commerical equipment and will have to be standardized
184B (PRD) POLYTECHNIC RESEARCH AND DEVELOPEMENT CO INC WAVE GUIDE ATTENUATOR						17	No comparable signal corps equipment. This is commerical equipment and will have to be standardized
VIDEO DOPPLER SIMULATOR		†	†	†	†	18	This item manufactured by Hazeltine
(a) DUMMY I F STRIP COUPLER		†	†	†	†	19	(a) used when measuring response of the IF and AFC strips; To be fabricated at depot level
(b) VARIABLE BIAS SUPPLY		†	†	†	†	19	(b) used when measuring response of I F strip To be fabricated at depot level
TERMINATION PRD No. 114-A POLYTECHNIC RESEARCH AND DEVELOPMENT CO INC		†	†	†	†	20	Special test equipment to be standardized
SPECIAL DELAY LINE FOR AN/UPM-11A		†	†	†	†	21	Manufactured by Hazeltine Corporation
TOOL EQUIPMENT TE-113			†	†	†	22	
TOOL EQUIPMENT TE-73		†				23	

GLOSSARY

Section I. ABBREVIATIONS

ac	alternating current
afc	automatic frequency control
agc	automatic gain control
ccw	counterclockwise
cw	clockwise or continuous wave
dc	direct current
IF	intermediate frequency
kv	kilovolt
ma	milliampere
mc	megacycle
pps	pulses per second
prf	pulse rate frequency
tr	transmit-receive
RF	radio frequency

Section II. DEFINITIONS

Antenna site—That portion of the radar site where the antenna assembly receiver-transmitter and modulator units are located.

A-scope—A cathode-ray tube indicator with a horizontal sweep. Signals appear as vertical deflections on the sweep.

Automatic frequency control—Control circuits that vary the local oscillator relative to the magnetron frequency, thus maintaining a stable intermediate frequency.

Automatic gain control—A method of automatically regulating the gain of the receiver so that the output tends to remain constant, regardless of the variation in signal strength.

Boxcar detector—A vacuum-tube circuit which detects frequency changes (occurring at an audio rate) in video signals, during the range gate period.

Cathode follower—A vacuum-tube circuit with high input impedance and low output impedance, in which the input signal is applied between the grid and ground, and the output taken from cathode to ground.

Clamp—A vacuum-tube circuit which maintains either amplitude extreme of a wave form at a certain level.

Duplexer—A combination of a transmit-receive switch and antitransmit-receive switch (short slot hybrid) with transmission lines, which enables the same antenna to be used for both transmitting and receiving.

Echo signal—A portion of the energy of the transmitted pulse, which is reflected by a target, back to the source.

Feedhorn—An open-ended metallic device for concentrating energy from the waveguide to the antenna reflector.

Ferrite isolator—An electromagnetic device which permits unidirectional passage of the transmitted pulse from the magnetron.

Frequency converter or mixer—A vacuum-tube or crystal circuit used to combine the incoming and local oscillator frequencies to produce an intermediate frequency.

Gate—A square-voltage wave which switches a circuit on or off electronically, usually by application to a grid or cathode of a vacuum tube.

Interlock—A normally open switch placed in a unit, which must be closed by sealing the unit, to permit application of power or high voltage.

Local oscillator—The oscillator used in a superheterodyne receiver of a radar set, the output of which is mixed with an RF carrier (echo signal) to form the intermediate frequency.

Magnetic amplifier—A current-controlled saturable reactor, which controls the power applied to a motor.

Magnetron—A transmitting tube which produces pulses of high frequency energy. The flow of electrons is controlled by a magnetic field.

Mixer—See frequency converter.

Modulator—That part of a radar set which controls the application of plate voltage to the magnetron.

Multivibrator—A form of relaxation oscillator, essentially a two-stage amplifier with feedback. Will oscillate of its own accord, or as the result

of the application of an external synchronizing voltage.

Operator's site—That portion of the radar site where the coordinator unit, plotting board, power supply unit, radar set control unit and shelter (if used) are located.

Potentiometer—A resistor with a variable contact arm, so that any portion of the potential applied between its ends may be selected.

Pulse forming network—A combination of inductors and capacitors used to produce a square pulse of controlled duration.

Pulse repetition rate—The rate (usually given in pulses per second) at which pulses are transmitted from the radar set.

Pulse transformer—A special transformer designed to have a frequency response suitable for passing a pulse without materially altering its shape.

Rectifier—A device used to change alternating current to unidirectional current.

Resolver—Essentially a transformer with mechanical and electrical inputs, which trigonometrically resolves the inputs into one or more outputs.

Rundown generator—A vacuum-tube circuit designed to produce a linearly decreasing output.

Servo—A complete electromechanical system for simplifying and transmitting accurate mechanical position from one point to another by electrical means.

[AG 413.44 (29 May 59)]

Short slot hybrid—An electrical device which attenuates the transmitting pulse in one direction and the echo signal in the opposite direction.

Slant range—The straight-line distance from the radar antenna to the target. Used in contrast to ground or map range.

Synchro—A single-phase, self-synchronous machine which converts mechanical position into electrical signal or vice versa.

Thyratron—A hot-cathode, gas-discharge tube in which one or more electrodes are used to control electrostatically, the starting of a flow of current.

Trigger pulse—A pulse which starts a cycle of operation.

Tr tube—Transmit-receive tube. A tube which acts as a switch and prevents the transmitted energy from getting to the receiver but allows the received energy, which is much weaker, to reach the receiver without appreciable loss.

Video—The intelligence of a radar echo.

Video amplifier—An amplifier which has uniform response to signals of a very wide band of frequencies.

Waveguide—A hollow pipe, usually of rectangular cross section, used to transmit rf energy. The cross section dimensions of the pipe are determined by the transmitting frequency.

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

ASA (2)
CNGB (1)
Technical Stf, DA (1) except
CSigO (30)
Technical Stf Bd (1)
USCONARC (5)
USA Arty Bd (1)
USA Armor Bd (1)
USA Armor Bd Test Sec (1)
USA Inf Bd (1)
USA Air Def Bd (1)
USA Air Def Bd Test Sec (1)
USA Abn & Elct Bd (1)
USA Avn Bd (1)
USA Arctic Test Bd (1)
US ARADCOM (2)
US ARADCOM Rgn (2)
OS Maj Comd (5)
OS Base Comd (5)
Log Comd (5)
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First US Army (7)
Corps (2)
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Yuma Test Sta (2)
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Svc Colleges (5)
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USASCS (25)
Gen Depot (2) except
Atlanta Gen Depot (none)
Sig Sec, Gen Depot (10)
Sig Depots (17)
AFIP (1)
WRAMC (1)
AMS (1)
Engr Maint Cen (1)
USA Comm Agcy (2)
USA Sig Comm Engr Agcy (1)
USA Sig Eqp Spt Agcy (2)
USA Sig Msl Spt Agcy (13)
Trans Terminal Comd (1)
Army Terminals (1)
Port of Emb (OS) (2)
OS Sup Agcy (2)
Sig Fld Maint Shops (3)
Sig Lab (5)
Mil Dist (1)
USA Corps (Res) (1)
Sectors, USA Corps (Res) (1)
TASSA (15)
Midwestern Rgn Ofc (TASSA) (1)
JBUSMC (2)
USA Sig Pubs Agcy (8)
Army Pictorial Cen (2)
USA Ord Msl Comd (3)
Units organized under following TOE's:
11–7 (2)
11–16 (2)
11–57 (2)
11–117 (2)
11–155 (2)
11–500 (AA–AE) (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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